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ALING WITH THE MANUFACTURE USES AND POTENTIALITIES OF PLASTIC MATERIALS

THE NEW INJECTION MOULDING MATERIAL

BEXONE

VINYL RESIN
INJECTION MOULDING POWDER

★ **Free Flowing**
★ **Excellent Colours**
★ **High Impact Strength**
★ **Good Finish**
★ **Low Specific Gravity 1.14—1.16**

BRITISH XYLONITE Co LTD
B·X·PLASTICS LTD
HALEX LTD

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come and see us

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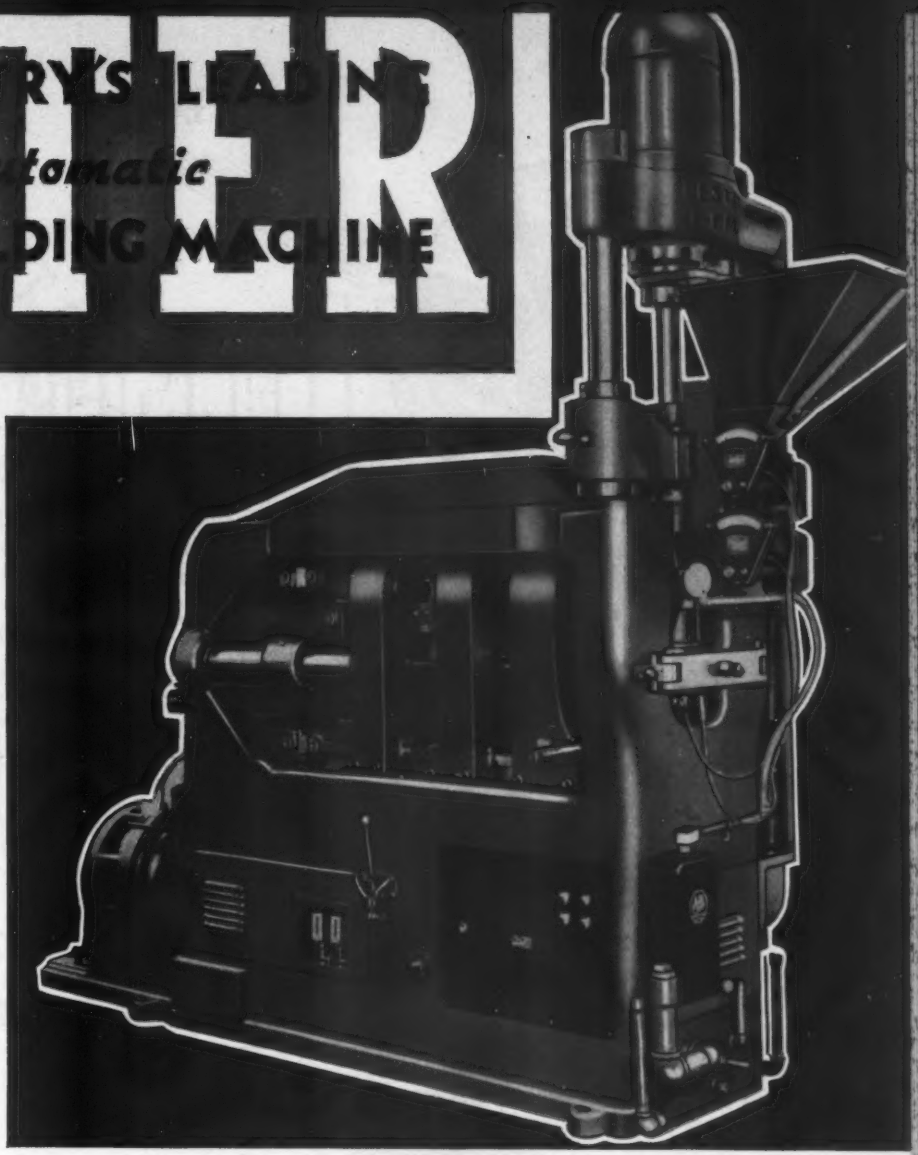
SUBSIDIARY COMPANY OF
THE BRITISH XYLONITE CO., LTD.
MAKERS AND MANIPULATORS OF PLASTICS SINCE 1877

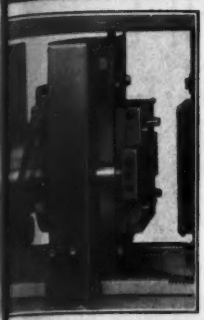
LESTER

PLASTIC INDUSTRY'S LEADING

Fully Automatic

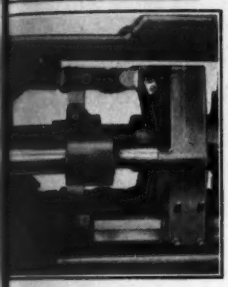
INJECTION MOULDING MACHINE





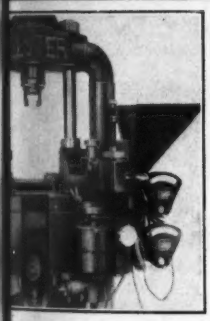
QUICK MOULD ADJUSTMENT

Rapid, uniform adjustment of die plates by worm and worm wheel. Perfect alignment of the faces of the mould is insured regardless of the skill or experience of operator.



POSITIVE TOGGLE LOCK MECHANISM

As the mould closes the cam faces on the toggles engage and take the entire force of the injection off the toggle pins and transmit it to the heavy castings of the machine. FLASH is thus eliminated.



EASY ACCESS TO REAR OF MOULD

The heating cylinder swings free of the machine, making it possible to adjust injection nozzle and heating cylinder in a few moments.

IMPORTANT MESSAGE TO MOULDERS

If you haven't considered adding Injection Moulding Equipment INVESTIGATE NOW! Many castings heretofore possible only in metal, etc., now successfully made in colourful plastics on I.M.C. Lester Designed Machines. Write us for details.

LESTER DESIGNED

FOR DEPENDABLE, TROUBLE-FREE OPERATION

Lester Equipment offers simplicity of operation, accuracy in mould set-up, large moulding capacity and low cost production. It brings back quick returns on equipment investment. These are only a few of the reasons why it has reached its enviable position of leadership in the industry. Behind all Lester's points of superiority is the valuable background of Lester's many years' experience in designing Pressure Die-Casting Equipment.

STANDARD CAPACITIES

4 OUNCE 6 OUNCE 8 OUNCE 12 OUNCE

Made in four standard capacity models. A large capacity machine often does the work of two smaller machines.

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WE'RE DOING A BIT OF REFLECTING THESE DAYS

. . . reflecting once more upon the services given by Plastics to Industry as a whole. Take this giant reflector, as an example. It measures 14 inches in diameter and its corrosion-proof surface is filling an urgent need in factories of many types. The same facilities and experience that carried this moulding from initial conception to practical design to moulding-press are available to you when you tell Ashdowns your manufacturing problems. Always consult Ashdowns first.

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PLASTICS PERFECT FASTENING

NOTE the double thread-cutting slot, which produces a sharp clean cut thread in any plastic material and assures easy driving.

cuts its own STANDARD MACHINE SCREW THREAD

CUTS OUT TAPPING

Tight and rigid fastenings in plastics can be made at much lower cost with the new Shakeproof Hi-Hook Thread-Cutting Screw. It taps and fastens in the same operation. A clean, sharp thread is obtained in any plastic material, because its double-slot design assures an acute cutting edge which drives easily, cleanly, and without fracture of the material. The fastening is tight, and should replacement ever be necessary, a standard machine screw of the same thread can be used. Reduce costs and speed up production by eliminating the cost of taps and the tapping operation. So that you can test this for yourself samples will be forwarded on request.

BRITISH PATENT Nos.
386,083 — 386,895 —
467,814 — 468,679 —
468,744—others pending.

SHAKEPROOF *Hi-Hook* **THREAD-CUTTING SCREWS**

MADE BY THE MANUFACTURERS OF THE SHAKEPROOF LOCK WASHER

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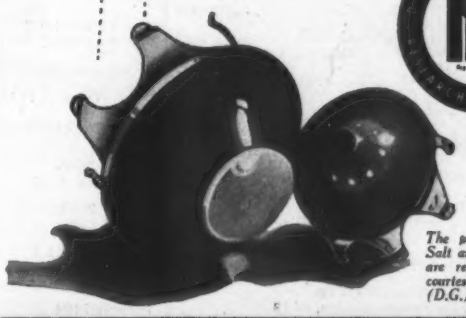
LARGE *or* small

Everything comes alike to us whether it's a salt or sugar pourer or an extra large moulding say for the electrical trade. Moulding is our job and our specialised organisation of technicians, designers, mould makers and very modern moulding equipment enables us to offer perfect mouldings of every type, simple or intricate, large or small. They all receive the same careful and expert attention. That is why our mouldings are distinguished for their fine finish, strength and accuracy—and prices are always competitive. *We can help you as we are helping other manufacturers with their moulding problems. Write us, we will gladly send a technical representative to discuss mouldings with you without obligation.*



The patent 'Snap-on' Salt and Sugar pourers are reproduced by the courtesy of Stourbridge (D.G.) Ware Ltd.

Moulded Products Ltd

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Longleys

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DAVY BROS., LTD., Park Iron Works, Sheffield	Sheffield 22161
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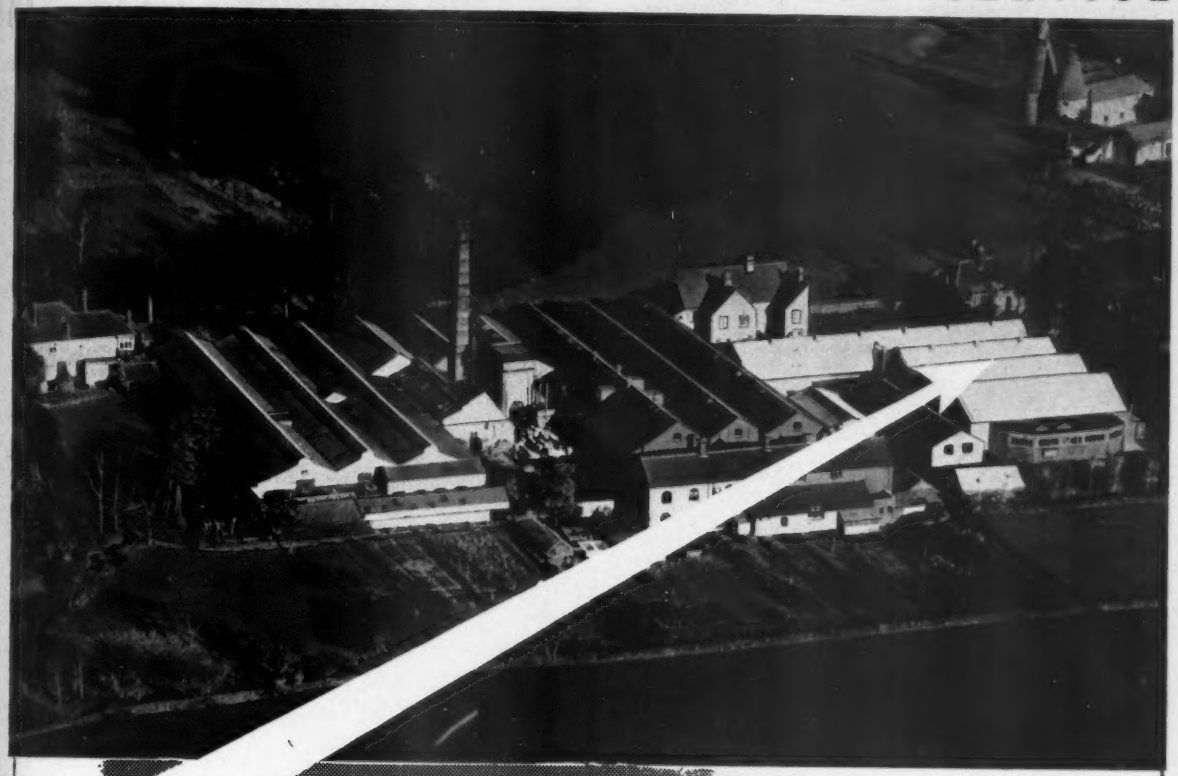
SEVEN AND A HALF ACRES OF SERVICE



THESE ARE THE SHOPS
THAT MAKE THE TOOLS
THAT MAKE SUCCESS

Making tools for a moulding is a craftsman's job—the success and sales-getting power of the moulding depends on it.
In Crystalate's modern and fully-equipped tool-making shops, indicated above, experts produce moulds that ensure—tool right—delivery right—moulding right. Just another link in the chain of Crystalate service . . . . a complete organization ready to work to your idea or submit new suggestions—from design to the finished article. Why not consult Crystalate?

CRYSTALATE

Crystalate Ltd. Enquiries to 153 Moorgate, London, E.C.2. MET. 5574/5. Works: Golden Green, Tonbridge. Established 1899

DIRECTORY OF THE INDUSTRY

CONTINUED FROM PAGE iv.

Manufacturers of Mouldings—*continued.*

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Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials.

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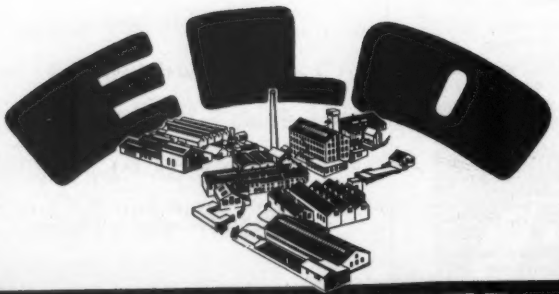

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Vol. III. No. 24 MAY, 1939

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - TEMPLE PRESS LIMITED
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Editor - - - M. D. CURWEN, B.Sc., A.I.C.
Offices - 5-17, Rosebery Avenue, London, E.C.1

METAL SPRAYING ON PLASTICS

WE have always been of the opinion that, for certain objects, it would be advisable and even desirable to combine plastics with metals. We refer, of course, to mouldings purely decorative in nature or to those which are sold to the public mainly or partly on their æsthetic value and not to those which must contain metal units for essential industrial uses. This opinion is sometimes regarded as heresy and against the very principle of mass production of plastic mouldings, especially when considered from the point of view of economics; for any combination with metals increases the selling price of the moulded object.

Obviously, however, if the moulded plastic object, combined with metal, were to sell better than the plain moulded object, then it would be a sufficient raison d'être. This would be an argument incapable of refutation by the most hide-bound plastic enthusiast and the whole of the plastic moulding industry.

Several attempts have been made, with varying success, to introduce such combinations. Most have taken the form of inlays. In one process a filigree or other metal pattern is placed at the bottom of the metal die and the moulding made on top of it and so incorporating it in the finished object. Another process, that of Plastic Inlays, Inc., as described in last month's issue, inlays metal that is quite immovable after the moulding has been made. Yet another employs electrodeposition or electroplating, in which the plastic surface must be carefully prepared beforehand. This method can produce any metal design on a plastic surface. We have even seen it employed to cover entirely a motor-car door handle, thus reversing the well-known process of moulding plastic round a metal die-casting. That such processes have been conceived, indicates a need for the production.

There is little doubt, we believe, that the sale of some commodities would be improved if more elasticity entered the moulding trade, and just as paint spraying is utilized as a matter of course for some plastic jobs, so the inclusion of metal might prove a useful adjunct.

It has, for example, been pointed out to us that the cup or saucer in plastics would be an improvement if it emulated the porcelain article more. In other words, we never see anything but a plain coloured plastic cup. There is never any additional decoration. It has become a very static object, whereas the porcelain cup has always been "dynamic." This is undoubtedly true, and it may be that this has been the reason for the use of the plastic cup only for very limited purposes.

Are these limitations in surface design responsible for the restricted sale of other plastic objects, when the sale in the same objects in wood or other material is unrestricted? Is this partly the reason for lack of appreciation of the plastic radio cabinet in this country?

And if this were true, it appears that new methods of approach are necessary. Incorporation of metal in some form or other does give a new means of decoration. Were it possible it would at once lift the cup and saucer, for example, out of the 3d. and 6d. multiple store trade, and create a new market, more restricted, obviously, but possibly almost as valuable.

With the limitations of those previously described processes and the difficulty of producing perfect electroplating on a non-conducting body, it is hoped that new processes will arise.

One potential method appeals to us greatly, viz., that of metal spraying.

First, let us admit that such a process has, to our knowledge, never been attempted and may prove quite impracticable. Yet, if practicable, it should prove reasonably economical.

The suggestion came to us because of some past experience in the chemical industrial field, utilizing what was originally called the "Metallisation" process, in which a ribbon or rod of metal passed through a hot flame in a pistol resembling closely a paint-spray pistol. The metal was "atomized," projected against a steel and iron sheet which was covered perfectly with the new metal. It is now everyday knowledge that chemical apparatus in steel may be lined with a coating of lead, copper, aluminium, zinc, etc., in order to protect it. The process has, during the past few years, been exploited by the British Oxygen Co., Ltd., and recently, while at their stand at the B.I.F., we discussed metal-spraying on plastics. The representative had never heard of it being done, but was emphatic about the practicability. What would be necessary, he said, is a preliminary preparation of the surface, such

as sand-blasting, in order to make an efficient key for the metal. In actual manufacture, no doubt, such a surface preparation would often be done in the mould itself and the spraying performed, using a special type of stencil. In addition, it is probable that a light polishing of the metal surface would be necessary.

Moulded Furniture

THE problem of producing furniture by the moulding of synthetic resins, as distinct from fabrication using laminated veneers, has long been in the thoughts of the plastic industry. Indeed, a limited number of moulded objects, such as fire-curbs and fire-screens, tables and stands of various forms have appeared on the market during the past two or three years. The pioneers in this section of the industry have been Ashdowns, Ltd., through their subsidiary Moulded Furniture, Ltd., of St. Helens, Insulators, Ltd., and E. K. Cole, Ltd. Within the past month further progress is indicated by the collaboration between British Industrial Plastics, Ltd., and a High Wycombe concern of furniture makers. As a result, a company entitled Form Furniture, Ltd., has been formed to exploit the new project. Naturally enough, progress is somewhat slow, since the preliminary outlay of steel moulds for the large objects is extremely high.

An interesting lecture on the difficulties involved and the advantages of plastic moulded furniture was given recently by Mr. H. V. Potter, managing director of Bakelite, Ltd., before the Plastics Group of the Society of Chemical Industry. Especially informative was his discussion of the economics of moulded production compared with constructions of wood. Generally speaking, the cost of wood is small, but the object to be formed had to be built up from pieces cut to size, planed and sanded, fitted together by glue or nails and completed for sale by staining, varnishing or polishing. The cost of wooden furniture lay largely in the assemblage and finishing processes and not in the cost of the raw material. When household goods are produced in very large quantities, moulding might readily prove much cheaper than when wood is employed. He gave a good instance in radio-cabinet manufacture. When the radio industry is flourishing and models can be made in quantities up to 100,000 or more, moulding is a most economical proposition. With small quantities, wood is cheaper to use. In his opinion, with increasing general prosperity and the introduction of cheap television for the general public, manufacturers would turn more to the moulded cabinet.

And Now—Houses

ABOUT a year ago we described a new air-conditioned portable room made for West Africa, to be used for invalids and the like. To us the interest lay mainly in the fact that the outer wall was built of Bakelite laminated sheet, making it very amenable as a portable structure. It was, of course, virtually indestructible and highly resistant to termites and bacteria. No doubt most of us translated this information into buildings of the future.

To-day comes the news that the plastic house is a fact in America. No doubt climatic conditions are responsible for the innovation, since there are districts in the U.S.A. that can be considered tropical or, at least, sub-tropical. Termites or white ants have systematically invaded certain districts until they have become, not merely a nuisance, but a real danger. Stories of total collapse of houses have come to our ears and if this has not always been due to termites, it has probably been due to heavy bacteria attack.

A five-roomed residence, costing $3,500, has been designed especially for such districts by a well-known American architect, John Yeon. The exterior is constructed of synthetic resin-bonded plywood using Durez as the bonding medium, providing not only a very desirable smooth wall construction from the hygienic point of view, but also one of permanent strength, insulation against extremes of temperature, and resistance to insect and bacterial attack. This structure also brings other advantages in its train. The window treatment, for example, is unique. Every one is sealed tightly, positively air and moisture proof, while ventilation is provided by louvres beneath the windows. Indeed, so tightly constructed is the house, it is stated that when all exterior doors and ventilating louvres are closed, the fire will not draw!

Protective Wrappings

THE development of protective wrapping materials for foodstuffs, tobacco, medical supplies and other articles in need of a hygienic form of protection has occupied the attention of research workers for some years now. We have, at various times, stressed the importance of this subject and suggested ways and means whereby the purity of foodstuffs can be adequately protected. The real enemies of perishable foods in transit are mould spores and bacterial infection carried in the dust, and moisture. It is a fact, of course, that in many cases these two are closely related, so that mould does not put in an appearance unless conditions are favourable to growth, and this means the presence of moisture. Not only is "Cellophane" cellulose film extensively used to-day for the protection of a large range of foods, tobacco and other supplies, but several interesting new materials have been developed. The use of chemicals for wrappers for fruit, chocolate, cigarettes, etc., has made considerable progress in recent times. In Palestine, where the growing of citrus fruits has received great encouragement by the authorities, successful experiments have been carried out with diphenyl for the impregnation of wrappers used for the shipments of oranges, lemons, grape fruit, etc. It is claimed that the use of these wrappers allows transport over long distances, reduces loss from rot, and does not impair taste or appearance of the fruit. Diphenyl is an interesting chemical which, until a few years ago, was little more than a laboratory curiosity.

The use of paper impregnated with vinyl resin for packing tobacco has recently been patented in Canada. The vinyl resin renders the paper resistant to moisture and also improves its strength and durability. Incidentally, vinyl chloride and other forms of vinyl resin are excellent as liners for food, drug and cosmetic containers, bottle caps and a host of other commodities. They have an exceedingly low moisture absorption and are non-toxic, tasteless, odourless and chemically inert.

Another method of impregnation for paper wrappers makes use of casein, soap and a hardening agent, such as formaldehyde. It is claimed that the treated paper is odourless, tasteless and highly resistant to moisture. There is no doubt that this process could be carried out very easily and economically on a large scale, and we anticipate some interesting developments.

RESEARCH EMPLOYS PLASTICS

Transparent plastic materials are being used more and more in building small-scale models as a means of determining the most advantageous designs for structures of many descriptions. The ability to observe what conditions will be encountered in service is definitely helpful to designers and engineers. The work described in this article, which is quoted from the March "Du Pont Magazine," is typical of some notable hydraulic engineering problems that have been solved through laboratory research and the use of models

DURING the past 10 years the Hydraulic Research Laboratory at Carnegie Institute of Technology has been engaged in constructing and testing model dams and parts thereof for private industrial concerns and for the United States Engineer Office, in connection with the design of hydro-electric, navigation and flood-control projects in various parts of the United States and Canada. This work conforms with the modern world-wide engineering practice of using models to test the designs of hydraulic equipment under consideration. The cost of models is slight in comparison with that of actual structures, and for this reason it is generally considered inadvisable to risk making errors in the design of huge projects for the sake of eliminating the expense of constructing model studies.

In building recent hydraulic models at the Institute increasing use has been made of transparent "Pyralin" cellulose nitrate plastic, as the engineers of the laboratory staff have learned to appreciate its numerous advantages. "Pyralin" was used for several years in this laboratory to form some part of certain models where it was desired to observe the flow of water past a region involving complex surfaces to which glass could not be adapted. The success of these tests suggested further use of the material, and during

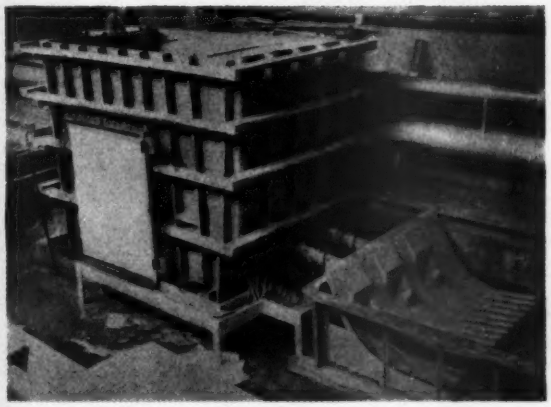


Fig. 1.—The Redbank model, showing the nearest conduit made of "Pyralin."

Fig. 2.—All conduits are shown in service discharging waters into the stilling basin.

Fig. 3.—Plastic model of the intake tower, designed to facilitate research studies in connection with the Tionesta Tunnel project. Transparent "Pyralin" helped.

the past year three models have been built in which the entire operating part contained "Pyralin." These were scale models of the conduits of the Madden Dam, Panama Canal Zone; the conduits and deflectors of the proposed Redbank Creek flood-control dam in western Pennsylvania, and the outlet tunnel for the Tionesta Creek flood-control dam, which is now under construction in the north-western part of Pennsylvania.

The Canal Zone Project

The first of these three, a 1-to-40 scale model of the conduits in the Madden Dam, was tested to develop a new design for the entrances of the conduits in order to eliminate the destructive cavitation that had occurred there. Cavitation, in brief, is a condition caused by water failing to maintain contact with the conduit wall in flowing around a corner or a sharply curved surface. The water thus forms a vacuum pocket adjacent to the surface in question, and the violent turbulence at the downstream end of the pocket hammers the wall with enormous force. This continual hammering causes the eventual destruction of the surface, regardless of the material of which it is composed.

The scale model of a single conduit was constructed to include the offending conduit entrance in the upstream face of the dam and a portion of the conduit wherein any cavitation might occur, including gate slots. This portion was carefully constructed, entirely of "Pyralin." Pumps, return lines, tanks and other apparatus used to simulate actual conditions in the prototype dam—except those in the region of the cavitation—were made of standard materials. Cavitation could be detected through the "Pyralin" by the appearance of white flashes in the flowing water in the critical regions. The coincidence of these regions with the damaged areas in the actual dam proved the model to be simulating prototype conditions. It then remained to develop and substitute corrected designs in the conduit entrances and to observe that they were free from cavitation flashes, thus indicating that the new design had corrected the undesirable condition. On the basis of this assurance that the new design will be satisfactory, a recommendation has been made that the conduit entrances be reconstructed.

The Western Pennsylvania Project

The Redbank model was built on a scale of 1 to 24 and represented three outlet conditions of the Redbank Dam. It was constructed to test the characteristics of

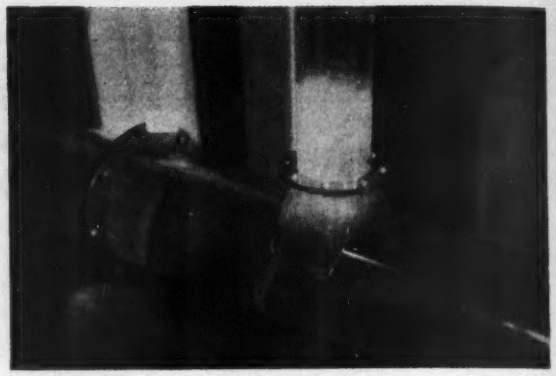


Fig. 5.—In this picture may be seen the plastic vent stack fabricated of celluloid so as to allow study of water movement under conditions approaching reality.

the conduits and deflectors when discharging into the stilling basin below the dam. Every feature that might affect the hydraulic performance of the sluices was reproduced in the model conduit, which was constructed of "Pyralin." These features included the trash-rack structure at the entrance, the gate slots and the service-gate vent. It was desired to discover the amount of energy loss due to the gate slots, and also to determine the best deflector design to dissipate the energy of the discharge from the conduits.

The model consisted of a large headwater tank with three conduits discharging into a stilling basin completed with return lines, pumps, and so forth. "Pyralin" was used in the conduit because proper dimensions could be more accurately obtained than with sheet metal or other material, and because the more accurate dimensions made possible obtaining more accurate pressure readings to determine the gate-slot loss. It was also possible to observe the effect of the vent on the flow at the gate slots. In the deflector proper the use of "Pyralin" was found most satisfactory, because this material could be moulded and cemented into complex shapes and surfaces with marked fidelity to proper dimensions and was free from the warping action characteristic of sheet metal or wood when subjected to the conditions met in testing.

The result of this model study was to develop proper designs to prevent excessive gate-slot loss and to produce a satisfactory system of dissipating the

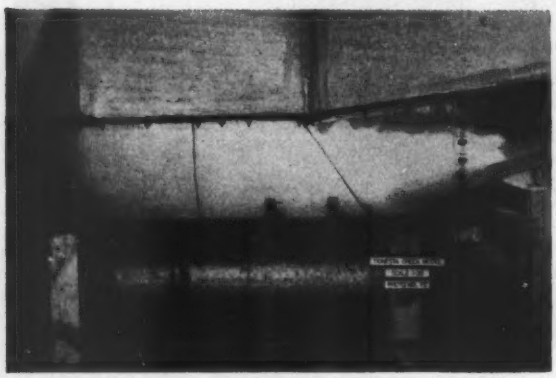


Fig. 4.—At the lower end of the 75-ft. Tionesta Tunnel model was this stilling basin.

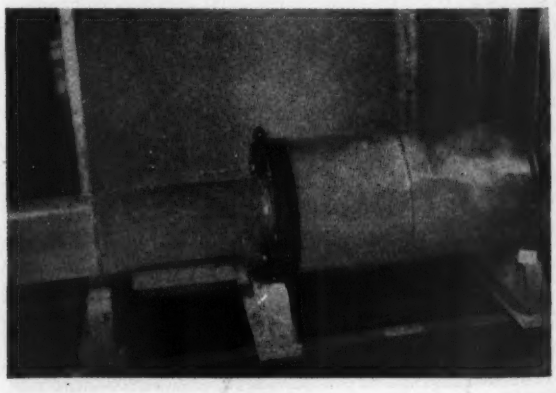


Fig. 6.—An energy chamber: both units were tested in the Tionesta Tunnel model.

discharge energy in the stilling basin. Fig. 1 is a general view of the model while not in operation, and Fig. 2 shows the model with three conduits discharging water into the stilling basin.

The 1-to-36 scale model of the outlet tunnel for the Tionesta Creek flood-control dam is the largest, most complicated piece of "Pyralin" work that has been constructed in this laboratory. The Tionesta Dam is an earth-fill structure at the lower end of a large U-bend in Tionesta Creek, about a mile upstream from its junction with the Allegheny River. The prototype outlet tunnel is a bore 19 ft. in diameter and nearly 2,000 ft. long, cutting diagonally through the hill from the upper part of the U-bend and discharging into the creek bed a short distance below the toe of the dam. This tunnel is the by-pass for the waters of Tionesta Creek around the dam and will take care of all normal and most flood discharges in the creek. An emergency Saddle Spillway is provided to take care of abnormal conditions. It was desired to study the action of the water in this tunnel and at the intake tower under various discharges; also to determine the effect of a vent stack and of an energy chamber if incorporated in the tunnel's construction.

This model was about 75 ft. in length and included a large storage tank at its upstream end. Next to the tank was the intake tower, which admitted water to the tunnel, the latter amounting to 61 ft. of the total length and discharging into a stilling basin at the lower end. Pumps and return lines completed the model. The model intake structure had to be constructed with extreme accuracy, and the success in completing this complex portion of the model is a tribute to the skill of the men who did the work. Fig. 3 shows the intake tower made of transparent sheeting. Fig. 2 shows the "Pyralin" construction in the stilling basin. Figs. 5 and 6 are views of the tested vent stack and energy-chamber arrangements.

As a result of observations made on this "Pyralin" model, the energy chambers were discarded and the vent stack was found to have certain valuable features. Action of flows at various discharges through the gates and in the tunnel was noted and recommendations were made as to the final design.

The work of this laboratory has been satisfying and successful because the models have always furnished a tangible result; a sound and definite proof as to whether a given design should be recommended, dismissed or modified. As time passes the number of problems to be solved in the laboratory increases and their nature becomes more complicated. "Pyralin" has taken a definite place in this experimentation. Its value is not limited to cases of observation, but also where accuracy of dimension and trueness of shape are essential. Some difficulties have been encountered due to the tendency of the material to expand and warp after extended periods of idleness in the model. This is more notable in the thinner stock. Experience has taught that the thicker "Pyralin" sheeting gives much less trouble from warping and it is now used wherever practical.

Air Conditioning makes use of Plastics

An interesting use is made of phenol-formaldehyde mouldings in the construction of the well-known Ozonair apparatus. The principle employed is based on the well-known and powerful oxidizing properties of ozone, which is a concentrated form of oxygen. Ozone is formed in the apparatus by subjecting the air to the action of a silent electrical discharge. The ozone produced by the Ozonair apparatus is absolutely pure and entirely free from harmful impurities, such as the oxides of nitrogen, which at once neutralize the good effects of the ozone.

Many thousands of these ingenious machines are in use in all parts of the world and are very efficient in removing stuffiness and neutralizing all odours found in houses, offices, etc.

The use made of synthetic resin, for moulding the body of the apparatus, is designed to ensure the highest degree of insulation and to combine a permanent attractive appearance with durability under all service conditions, and lightness in weight and portability.

Eight-pound "Diamond" Made of Lucite

A man-made "diamond," weighing more than 57,000 carats, or a little more than 8 lb., has been cast of Lucite and finds a perfect setting on Treasure Isle in "The Wonder World of Chemistry" at the New York Fair. The "diamond" was first cast in a glass cylinder: this, when broken, revealed a casting without perceptible flaw. An expert craftsman spent eight days cutting it to form a perfect "diamond" over 9 ins. in diameter at the girdle and with a total of 56 facets.

The Cullinan, largest diamond ever discovered, weighed about 3,025 carats before it was cut into the nine smaller stones now forming part of this country's crown jewels. Yet even this unusual gem is dwarfed by comparison with Du Pont's man-made masterpiece.

"Stained Glass Windows"—but with Plastic Sheet

A new invention considerably increases the possibilities of this beautiful method of decoration at low cost, and even widens the application to spheres which the ordinary coloured glass cannot hope to enter

A scheme built into a fanlight gives a brilliant spot of colour.

THE "stained glass leaded window" of the future will, we believe, be of more than casual interest to producers of plastics, for the transparent sheet or foil has suddenly created the possibility of a new minor industry—the production of transparent coloured panels.

In a few words, an ingenious mind has translated the "safety glass" sandwich into the realms of art with an effect that is startling, has opened up avenues of interior and exterior decoration that have never been dreamt of before by the architect, and, one can say almost inadvertently, also brings an important safety factor into such decorations.

The limitations of the ordinary stained glass window for general acceptation are rather obvious. The very costly manufacture of coloured glass, the limitations of size of the pieces of coloured glass, the costly fitting them in lead frames, and the limitations of design and even of colour and finally the possibility of breakage,

Decorative panel, 22 ins. by 32 ins. Transparent for daylight or semi-opaque for back-lighting artificially.

has not given the architect or designer a facile material for his exploitation.

The new process may be summarized as follows:—

Two sheets of glass are employed. On the one an opaque design is painted or printed in obverse and on the other the same design is formed in reverse; thus coinciding when these two surfaces are placed together. Between the two glasses pieces of transparent coloured plastic sheet such as celluloid or cellulose acetate are positioned so that the edges of the plastic are hidden or enclosed by the lines of the pattern. The sheets of glass are then joined or held together by adhesive or by a framework, for example, of lead. Although simple designs are extremely attractive in the stained and leaded glass window, the process under discussion allows for much more complicated work. It will be readily realized that the simple monochrome may be further embellished by shading or by intricate line done by a brush direct on to the celluloid or acetate inter-layer before the second sheet of glass is attached to the first. The printing plate can also obviously be employed for rapid reproduction.

As for the colour range available, this is very wide indeed. Manufacturers are now producing sheet in some two dozen colours, but it is interesting to realize how simply a new colour may be obtained by superimposing one piece of coloured plastic sheet on another. It is also worth noting that, since the coloured strips or pieces may be positioned without a border line, it is readily possible to obtain special effects, for example, closely registered strips may be arranged to give a rainbow effect without black lines between the spectrum colours.

The panels may be made in large sizes and used directly as windows or they may be made small and hung as decorative coloured spots of plaques inside ordinary windows. Other attractive suggestions that have been made are as ceilings or parts of ceilings incorporating lighting systems, inlaid wall-panels illuminated from behind, and lamp and lantern shades. This type of decoration should be especially suitable

(Left) Decorative panel, 22 ins. by 32 ins.

(Below) Panels ranging in size from 6½ ins. by 4½ ins. to 12 ins. by 8 ins.

to the modern designs employed in restaurants and hotels. As an advertising medium the process lends itself admirably when rear-lighting is available, especially since transparent film positive showing the article for sale can be readily incorporated in the remainder of the design. Being perfectly smooth on each side the panels can be cleaned as easily as the ordinary glass window.

We should be glad to furnish more details to those who may be interested in this patented process.

C

"General Release"—I

New and Interesting Plastic Goods

A SMART-LOOKING electric clock for home or office is this new Chieftain model of the Pennwood Co., moulded by Bridgeport Moulded Products Co., U.S.A. The rich black moulded Durez plastic case, which completely protects the working parts, won't scratch or mark easily, nor lose its lustrous finish.

THE Dorcas Thimble Stand is moulded of phenol-formaldehyde resin by Ashdowns, Ltd., St. Helens, Lancs, for Messrs. Charles Horner, Ltd., Mile Cross Works, Halifax, and is one of the neatest and most effective examples of plastics display stands we have seen this year.

NON-ELECTRIC deaf aids are now almost exclusively moulded of cellulose acetate in place of the more expensive real tortoiseshell, which was at one time preferred. G. H. Gregory and Co. (Plastics), Ltd., 79, Lea Bridge Road, London, E.10, are specialists in the moulding of these delicate instruments. Those illustrated are made of Rhodoid.

FOR industrial use this giant reflector, measuring about 14 ins. in diameter and 11 ins. in height, is moulded of phenol-formaldehyde resin, with the inside, or reflecting surface, sprayed with a white cellulose lacquer. Ashdowns, Ltd., St. Helens, Lancs, are responsible for the moulding.

HERE'S a charming Bexoid packing for a nursery toilet set, also moulded of Bexoid by Halex, Ltd., a subsidiary company of the British Xylonite Co., Ltd. Both the design and decoration of this set are calculated to make a wide appeal to fond mothers and generous relatives.

MOULDED opera glasses in phenolic and amino resins are now becoming very popular, and the pair illustrated is an excellent example of English manufacture. It is made by Soho, Ltd., 3, Soho Square, London, W.1, in 10 different colours.

"General Release"—II

New and Interesting Plastic Goods

THIS efficient-looking paper-knife is likely to be a popular present from Blackpool for many thousands of visitors this year. It is moulded of ivory Beetle by the Streetly Manufacturing Co., Ltd.

THIS colourful little container for the Razorette is literally a prize-winner, having won top honours in the Plastics Section of the All-America Package Competition. It is moulded of Lumarith by the Chicago Molded Products Corporation, of Chicago, Illinois, for the St. Clair Manufacturing Co., of Detroit, Michigan. Lumarith is a product of Celluloid Corporation.

THESE three seal impressions in Cellomold show the remarkable fidelity of detail which it is possible to obtain by the use of this moulding powder manufactured by F. A. Hughes and Co., Ltd., Abbey House, Baker Street, London, N.W.1.

MOULDED handles for electric irons and other domestic appliances have now become almost commonplace, but this sturdily designed example is certainly a leader in its particular class. It measures 6¾ ins. and is moulded of reinforced phenol-formaldehyde resin by the Gorham Co., Plastics Division, U.S.A.

A BEAUTIFULLY designed two-way window box which won a recent award in an American 5 and 10-cent store package competition. It is a product of Baronet-Lorna Co., Inc., and Robertson Paper Box Manufacturing Co. made the box. The two-way window is Lumarith Protectoid, a product of Celluloid Corporation.

TIME-SAVING gadgets always fascinate us, and we are particularly pleased with this dainty little peeling device equipped with a brightly coloured and eminently practical Catalin handle.

PLASTICS for SCHOOL HANDICRAFTS

by
F. G. WOODIWISS

The author, who is a Registered Industrial Art Designer and Member of the Royal Society of Teachers, is one of a very small band who can speak with authority on the subject of Plastics in Schools. Following a visit to the School Department he controls, we came away more than ever convinced of the importance of such work to industry and to our modern life in general. The photographs of the work done by boys of 13 and 14 in Mr. Woodiwiss's school speak with emphasis to the world of modern education.

IT is estimated that the present world output of plastics is in the neighbourhood of 150,000 tons, involving an expenditure of £70,000,000. There is every prospect of this figure increasing. These materials are thus not only impressive from an industrial point of view, but also because they obviously affect the beauty and order of our lives. On these latter counts alone they should receive attention in our schools.

The "Council for Art in Industry," in their report "Education for the Consumer," strongly recommended that in connection with Art and Craft Education not only should articles actually made in the school have attention paid to their design, but that these lessons should serve as a means of stimulating interest in the design of everyday machine-made objects. A moment's thought will soon show that it is educationally unsound to stop short at handicraft methods; a lively interest in the methods of industry and its products, and the direction in which they are heading, will bring school subjects into healthy contact with reality.

The words of a well-known pioneer of the modern movement, Professor Gropius, are well worth repeating here:—"Handicraft and industry must be understood as opposites perpetually approaching each other. Handicrafts are now changing their traditional nature. In future their field will be in research work for industrial production, and in speculative experiments in laboratory workshops where the preparatory work of evolving new type-forms will be done."

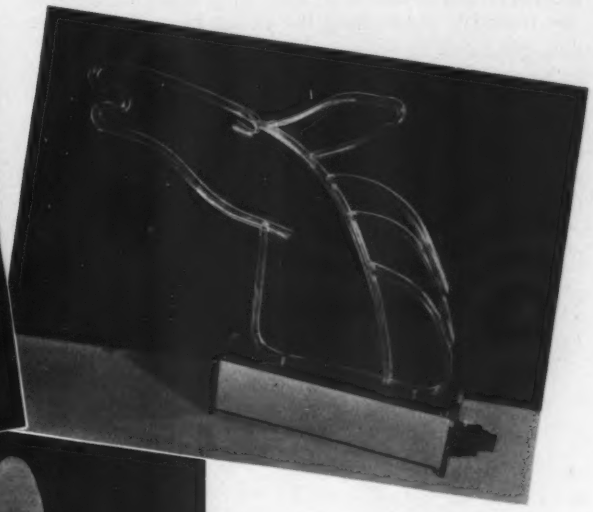
In the past, things were quite naturally made from materials that were to hand, and a great variety was not always available; but to-day modern methods of transport and the bewildering inventions of synthetic and semi-synthetic materials have removed this limitation. To-day, the first problem of the designer is not so much "How can he make such and such a thing from a particular material" as "What are the best materials for his purpose?" It follows that he must either have a knowledge of an extensive range of materials or the habit of mind and sense of direction which will lead him to find and experiment with the best materials for his purpose. The designer of to-day must therefore work in co-operation with numbers of experts in other branches of industry and commerce. The designer's problems are mentioned here because the modern craft teacher is faced with similar problems if he is to use his craft lessons complementary to an understanding and an appreciation of the best goods that mass-production can give. It is not suggested for one moment that the teacher, or the designer for industry for that matter, should attempt the impossible—the understanding of all the details of industrial processes, which are often the products of highly specialized brains. On the other hand, the underlying principles of mechanical processes are not much more difficult to understand than many of the simple processes used in everyday life. The implements are merely hand tools made stronger to allow for the application of power or adaptions of these to rotary motion.

Handicraft was introduced in schools, primarily because of the educational value of the manual training

involved. It was claimed, and still is, that the acquisition of manual dexterity in the manipulation of tools and material contributes to the development of the child. It is also claimed by some that the development of a child from babyhood to manhood corresponds to the evolution of the human race, and since, at an early stage of his evolution, man became a tool-using animal, craft work should naturally take its place in the school curriculum. Later on, craft work was looked upon as developing a means of self expression, and during this period various "arty crafts" crept in, so that a strong plea was made for the practice of only those crafts which could claim a traditional technique.

The crafts of woodwork and metalwork, now firmly established for senior boys, appear to answer these claims quite well, although when the metalwork takes the form of engineering tool-making, as it has done in a large number of schools, it is by no means an ancient craft.

This respect for tradition has in the majority of



All the objects on this page have been made by boys of 13 and 14 years of age from acrylic resin (Perspex) sheet or rod. The leopard is an example of modern fretwork—

—while the horse's head forms a lamp on a copper base and is designed to make use of the striking property of Perspex to transmit and diffuse light through curved forms.

In the centre is seen another beautiful lamp of the same material utilizing a copper central rod for contrasting decoration and support. Here is also seen a beautifully made sweet dish.

The lizard in the bottom photograph was cut out with a fret-saw, softened in boiling water and bent to shape. The legs were joined on with a transparent cement.

cases been a stumbling block to experiment in new materials, and this in spite of the fact that many authorities on education have advocated the use of a variety of media, besides encouraging the teachers themselves to experiment.

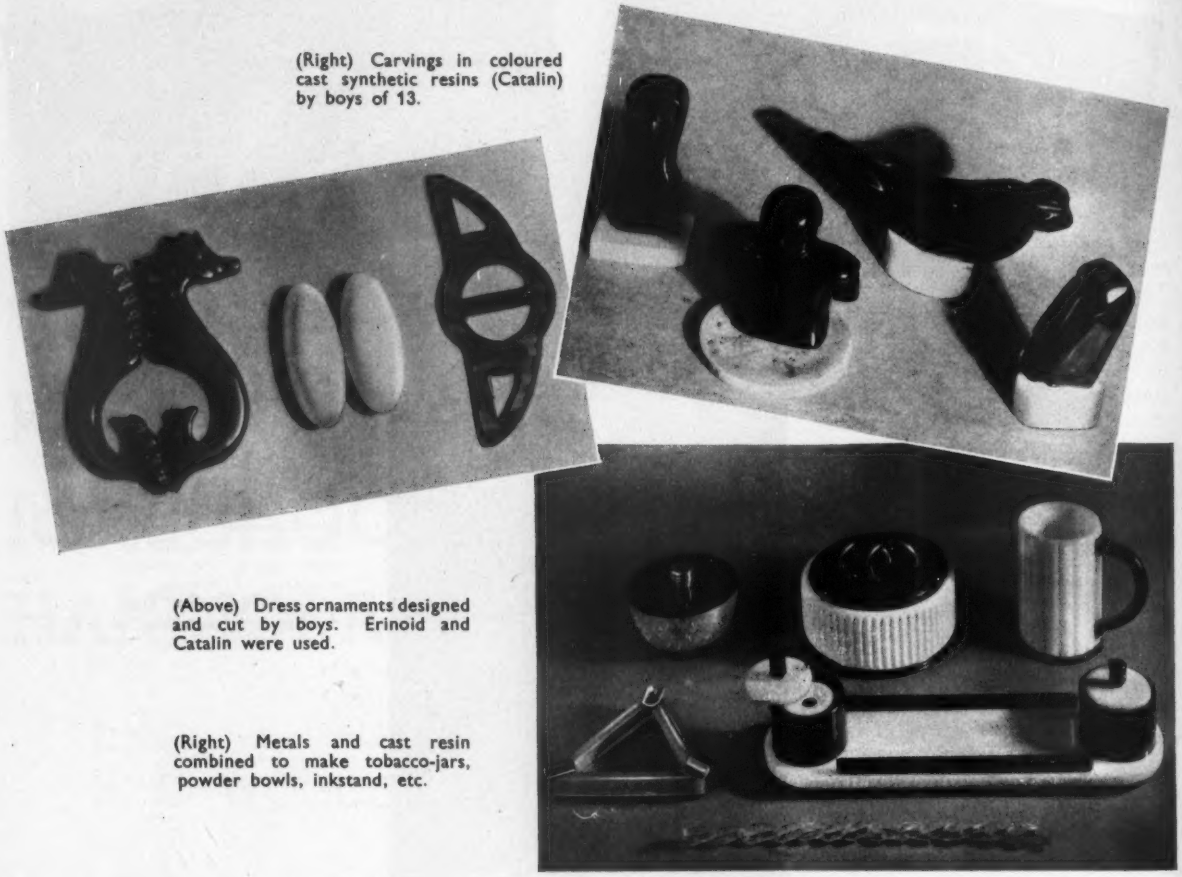
There are, of course, difficulties for the teacher in introducing new materials, and in embarking on experiments; the time available in schools for the practice of craft work is one of them. Perhaps the extra school year will assist here, and allow handicraft to enlarge its horizon by greater contact and co-operation with industry, and to finish its course by experimenting in the materials for making the things of to-day, and in all probability the things of to-morrow, that will affect the lives of the citizens of to-morrow.

Plastics have every claim to the consideration of the educationist on both grounds of providing a convenient means of manual training and as a means of self-expression. The majority of hardened plastics can be worked in a manner similar to metals, using the same tools, but with variations in their cutting edges corresponding to the variations necessary when dealing with different metals; but they go farther than that, since their application can include some of the technique of woodworking, pottery, moulding and casting, bookbinding, etc. There is hardly a handicraft process which cannot also be applied to plastics.

Some of the softer plastics can be planed and spokeshaved, and in the form of plates and sheets many woodworking joints, such as dovetailing and halving, can be adapted for constructing boxes and cabinets of gem-like beauty. Indeed, the advent of plastics has made possible the possession by everyone of articles with all the beauty of precious stones and other natural but expensive substances, such as tortoiseshell, ivory, crystal, ebony, amber and rare marbles. It may be argued that the comparative rarity makes the natural substances more attractive, but this is mainly snobbery and should be treated as such by educationists.

The property of such natural materials which should appeal most is their intrinsic beauty, and it is no exaggeration to say that this in many instances has been surpassed by the chemist producing plastics. It must be admitted here that, because some plastics were made to take the place of other materials, such as wood, manufacturers misguidedly took the trouble to imitate the form and surface pattern of wood, and although this was sometimes a very clever imitation, æsthetically, it left much to be desired.

In addition to inherent beauty, plastics have some outstanding properties which include inertness to strong chemicals, electrical insulation, properties comparable to those of fused quartz, low specific gravity, complete non-inflammability, zero water absorption, phenomenal optical properties, including transparency greater than glass, high light transmission, and polarization. Of course, all these properties are not to be found in all plastics, but the time is not far distant when the properties required in a material will be decided beforehand. This is done to some extent now, but those plastics in common use had their main properties discovered and exploited after they had been produced by the chemist, and it is here that the craftsman can be of special use in assisting in their development.



(Right) Carvings in coloured cast synthetic resins (Catalin) by boys of 13.

(Above) Dress ornaments designed and cut by boys. Erinoid and Catalin were used.

(Right) Metals and cast resin combined to make tobacco-jars, powder bowls, inkstand, etc.

The above physical and electrical properties should make a great appeal to the science teacher, and the craft master who specializes in science handicraft.

Plastics, because of their adaptability and varied properties, besides forming industries in themselves, are complementary to a large number of other industries, and they should at least be correspondingly complementary to existing school crafts.

Creative effort besides the acquisition of pertinent knowledge is looked upon as a necessity for the proper development of the child (and indeed for the adult). Plastics, because of the appeal of their inherent beauty, the many convenient forms in which they are available, and the ease with which numbers of them can be manipulated, are a great stimulant to creative effort.

In addition to the fact that they can be worked by the child of low ability there is no limit to the amount of skill that can be acquired in their manipulation, or to the application to plastics of the existing skill of craftsmen in other media.

The woodworker can easily fabricate handles and knobs to match his own design of furniture, from plastics. He can inlay and overlay with them, also veneer, or purchase wood already covered with a plastic of beautiful surface effect, which will be proof against water, spirits, cigarette burns and scratches; or he may use a synthetic resin varnish which will withstand strong caustic soda, and offer exceptional resistance to sun and salt water.

There is also a wide range of laminated materials available for him, of great strength and beauty, as well as various woods impregnated with synthetic resins, offering properties not to be found in the natural wood.

The metal worker has all the tools to hand with which to make an extensive range of articles in plastics, offering him a limitless field for the most fascinating experiments.

Plastics are also particularly suitable for engraving and carving, making possible beautiful and original effects cheap enough for all to practise.

Carving, in particular, offers a craft which is highly individual, and at the same time a convenient one for the teacher to run. With a piece of plastic, a few files, and perhaps a saw and a scraper, the child can be left to do his best (or worst) in carving a figure, such as a head. With timely comments by the teacher he can develop a sense of form and the proper treatment of material.

There is also much to be said for plastics being used as an introduction to craftwork. Because of the many properties already referred to, and the many convenient forms available, together with their ease of manipulation, it is possible for the novice, boy or girl, to make attractive articles from the beginning which will keep his interest going until such times as he can develop real independent skill. Facts and figures can be forgotten, but manual skill, once acquired, is there as long as the use is in the hands, giving a "joy in the making," which can last a lifetime.

It has taken a long time for some of our finest craftsmen to admit the advantages and usefulness of such new materials as plywood, although now, when properly applied, the latter is recognized as forming some of our finest furniture. It is hoped that this time lag in connection with the application of new ideas and new materials will be greatly reduced, and that the craftsman will deal with them, not with suspicion, but with the detachment of the scientist, and the purposefulness of the artist designer, discovering and exploiting their æsthetical and mechanical possibilities.

A class at work on plastics in an East End elementary school.

WORLD'S INDUSTRIAL

MOTORS

Perspex screen has been fitted to new racing car, record-breaking M.G. used by Major Gardner. Claimed that new screen gives perfect visibility under most difficult conditions of racing. Practical advantage of Perspex is that it can be formed to take any desired shape without difficulty. **Plastic motorcycle frames** will shortly be made in Germany, if a recent patent taken out by Auto Union, who produce the D.K.W. machine, is an indication. Design for the projected new machine is somewhat similar to that of the familiar Coventry-Eagle channel steel frame. It consists of two side pressings which are bolted together. When assembled, the middle part of the frame is circular in cross-section; within it is the cylindrical fuel tank, which is insulated with rubber. The engine gearbox unit is mounted in a channel-steel sub-frame of its own. It would appear that this could readily be detached from the main frame, which would certainly be a convenience to overhauling. The rear wheel is sprung, the design being unusual. Its mounting is a separate unit (again an assembly of two symmetrical pressings), pivoted just behind the gearbox. The springs, of the vertical coil type, are located by the rear number-plate. The rear wheel mounting is formed to provide a very deep mudguard, more than half the wheel being enclosed, and a plastic mudguard of similar type is contemplated for front wheel. Assuming adequate strength, a moulded frame would possess several advantages; it would be lighter, rust-proof, easy to clean and able to maintain its smart appearance almost indefinitely. Latest application of plastics in motorcycle industry in this country is the Bakelite instrument panel for last season's Triumph. **Reducing noise** in the modern car by the use of more plastic materials suggested by a writer in the March issue of *Matières Plastiques*. The author states that noise interferes considerably with the pleasure of motoring and points out that 60 decibels is really a high figure for the maximum noise in the modern car, although up to now the best designed motorcars give 100 decibels, whilst the autorails give 75-80. By using plastics in place of metal it should be possible, it is claimed, for manufacturers to reduce noise very considerably. New uses for plastics in the motorcar industry include grooved pulleys for radio ventilators, accumulator boxes, gear change covers, carburetter bodies and oil pumps.

ELECTRICAL

Arc-quenching tubes can now be made by modifying acrylic resins. Recent patent, B.P.499,456, taken out by British Thomson-Houston Co., Ltd., describes the manufacture and states that suitable proportions are 5-10 per cent. magnesium peroxide, 40-60 per cent. oxamide, and the remainder acrylic resin. **Dielectric material** of a promising description is described in a United States patent, 2130264. It is made by mixing at least 50 per cent. rubber with chlorinated diphenyl, the latter containing a minimum of 60 per cent. chlorine. **Short-wave transmitters** and receivers require the highest grade of component parts. Special low loss moulding material (X-262 Pat.) developed by Bakelite, Ltd., has made possible the success of new change-over switch now employed on Air Ministry short-wave sets. With ordinary materials the dielectric losses at high frequencies are serious, but the new material has proved quite satisfactory. Mouldings all produced by Birkbys, Ltd. **Insulating materials** are fully discussed in an article in *The Wireless World*, April 27, 1939, in which respective merits of the synthetic resins, polystyrol plastics and the methyl methacrylates are examined. Pointed out that most new thermoplastic materials, such as Perspex, Distrene, Trolitul, Victron, etc., require very careful treatment on drilling. Owing to their very low thermal conductivity, the heat generated by the drill cannot easily escape, and as the materials begin to soften at about 60 degrees C., they tend to become slightly gummy under the drill. Moreover, the subsequent solidification seems to set up internal strains, which may lead to eventual cracking of the machined component. Drilling should, therefore, be done slowly and water fed on to drill to assist cooling. **Corrosion prevention** receiving considerable attention by manufacturers and research bodies. The trouble is increased by presence of stray currents, especially when cables are run over bridges or in vicinity of electric train tracks or tram rails. Near sea coasts, corrosion of overhead work may be accentuated by salt spray which, under influence of ultra-violet rays and ozone, eats into galvanized iron shackles, supports, etc., corroding the copper conductors. The firm of Clough (Croydon), Ltd., now specialize in production of new type of rubber-wax compound which is waterproof, acid resisting and possesses high dielectric strength, with non-corrodible and non-absorbent qualities; can also be drawn into ducts. This compound claimed to be a great improvement on many existing bitumen and rubber-proofing agents. **Dielectric strength** of lacs of known origin is discussed in a contribution to *Current Science* (Bangalore, 1938, 7, pp. 49-51). Comparative data for the breakdown voltage of varnish films prepared from sagade seed lac and Jalari lac dried in different ways are recorded. After dissolution in sodium hydroxide and precipitation, seed lac acquires a higher breakdown voltage. **Radio manufacturers** now using increasing quantities of plastic laminated tubing. Recommended where material is needed having a low power factor at radio frequencies and an extremely low moisture absorption. Coils made from this tubing have constant inductance and resistance under widely varying climatic conditions. **Conduit construction** discussed in *Papier-Fabr 36 Tech.-Wiss.* The article deals with advantages and disadvantages of synthetic resins and other materials for electrical conduits. **Shellac mouldings** containing urea are stated by writer in Indian Lac Research Inst. Bull. No. 30, 8 pp. (1938), to have improved mechanical strength, heat and water resistance. Equal parts of shellac and wood flour, with 6 per cent. urea on weight of shellac intimately mixed in the presence of alcohol and dried.

GENERAL ENGINEERING

Coating metal with neoprene has now been developed commercially, so that it becomes practical to adhere it to a wide variety of metals. Dr. Felix Yerzley, of Du Pont de Nemours, made this statement at American Chemical Society's Convention, Baltimore, April 7, 1939. **Roll-neck bearings** of plastic materials are fully discussed in *Demag News*, Vol. XIII, C, No. 1. It is pointed out that most favourable form of a synthetic-resin plastic bearing is not always in accord with the conventional form of bearing, owing to characteristics of the material of the former.

TRIMPLOYS PLASTICS

Owing to the favourable coefficient of friction the load on rolling-mill engines will, it is claimed, be reduced from 10 to 40 per cent. Pointed out that, owing to poor thermal conductivity of plastic materials, bearings require more play between the bearing surfaces of the shells and the necks than bearings of base metals. **Bonding synthetic rubber** to metal described in B.P.493,139. Compounded plastic forms of synthetic rubber, e.g. neoprene, are attached to ferrous metals, and also certain non-ferrous metals, zinc, aluminium, lead, nickel and chromium, by coating the surface of the plastic and/or the metal with a solution of chlorinated natural rubber (45-67 per cent. chlorine), bringing the surfaces in contact and vulcanizing. **Cutting fluid** is very heavy on rubber base and manufacturers now use neoprene hose for longer life. January issue of *The Neoprene Notebook* by Du Pont gives particulars of new application. Case in point is a hose connection carrying cutting fluid on a valve-refacing machine, where the connection is subjected to considerable flexing. Rubber hose stood up only a short time. Neoprene gave practically unlimited life. **Tubes** for gas, water and other fluids recommended by E. Pallas (*Wärme*, 61, 235-8) should be made of Mipolam. Applications fully described in the article, also practical methods of jointing and strengthening tubes. **Heat insulation,** together with transparency, is stated to be possible by utilizing certain synthetic resins of the methacrylate type, e.g., Lucite, Perspex, etc.; Gucker and Ford (*Jour. Amer. Chem. Society*) have calculated that the specific heat of these compounds is sufficiently high to warrant such a use.

CHEMICAL

Protective clothing for workers in sulphuric acid plants is highly important owing to danger of accidents. Rubber-coated clothing has been tried out, but lasts only four to six weeks. Encouraging results now obtained by use of neoprene-coated suits, which, on test, gave good results for 5½ months. (Neoprene manufactured by I.C.I.). **Moulded closures,** able to resist nitric acid, now being made in America with polystyrene resins manufactured by Bakelite Corp., U.S.A. Reported that laboratory suppliers very interested in this new application. **Valve handles** for chemical plant now moulded in America of Durez, the well-known phenolic resin made by General Plastics, Inc. Sizes vary from 1⅛ ins. diameter to 3 ins. diameter. Advantages claimed are high resistance to acids, abrasion, humidity and other deteriorating conditions. Inserts can be moulded-in solidly if design calls for them. Phenolic mouldings can be drilled and tapped, moulded with threads that will not slip, with holes that may save a lot of machining later. **Bearings** of a special resistant character now made of resin-bonded cellulose. Reported that, owing to their high resistance to chemical attack, of great interest to chemical manufacturers. It is claimed that new bearings able to reduce power consumption by 50 per cent., thus ensuring very economical running. Information on subject obtained by reference to *Chem. and Ind.*, 57, 1053-2, No. 5, 38. **Pipes and fittings** for use in presence of corrosive chemicals now made of bakelized asbestos fabric, which is also highly resistant to heat. The Bushing Co., Ltd., Hebburn-on-Tyne, manufacture special grade of material, Grade 25, for this application. **Filter cloth,** made of vinyl resin threads, now used in German chemical industry. Starting-off point of manufacture is acetylene, which is converted into vinylic ether; this is made into fibres and polymerized. Tensile strength of new fibres 16 to 18 times that of cotton. Above 100 degree centigrade fibres disintegrate and filter, therefore no use for handling hot liquids. **Factory flooring** which is claimed to be chemically and mechanically resistant and suitable for acid plants, etc., is described in new patent, B.P.497,185. The floor consists of a layer of a rubber cement mixture, a layer above it of rubber, and an outer coating which may be jointless, secured to the latter layer and formed of material other than rubber, such as synthetic resin. Tanks also described in patent. The outer coating may consist of a layer about 5 mm. thick of a cold-hardening artificial resin mixture consisting of liquid phenol-formaldehyde resin, sand, quartz powder and a hardening accelerator, for example, ethyl sulphuric acid. **Chlorine-resistant paints** are discussed in an article in Mem. Inst. Chem. Tech. Ukrain Acad. Sci., 1938, No. 9, pp. 211-236. It is stated that the greatest resistance to corrosion by wet or dry chlorine was found for mixtures containing 50 per cent. pigment, 25 per cent. crude lignite bitumen, and 25 per cent. novolac resin or Acrolite. **Hydrofluoric acid** resistance is claimed for Trolitul by K. Holm (*Chem. Fabr.* 1938, II, 209-210) which is said to be unaffected by liquid or gaseous hydrofluoric and hydrochloric. Expected that this property will open up new applications in chemical industry.

BUILDING

Heat insulation may soon be carried out with a blanket or flock made up of synthetic cotton wool. According to *Manchester Guardian*, April 21, use of synthetic resins for producing such a wool recommended in new Continental patent. Polyvinyl compounds converted into spray in such a way that solvent evaporates before material is deposited; this result obtained by carrying out process in a rapidly moving gas. Claimed that material, owing to high acid resistance, would be useful for filters. **Building boards** and roof tiles soon be made of new plastic from coffee surplus. Reported in American journal, *Business Week*, 33-4 (January 28, 1939), that South American interests now developing process for turning 4,000,000 bag coffee surplus into new plastic for moulding several different building materials. **Library shelves** made of laminated material and measuring over 450 miles, to hold 10 million volumes, now in use in the new annexe of the Congressional Library in Washington, D.C. The material is made of Formica (Formica Insulation Co.). Counter tops, desk tops, delivery tables, baseboards, card file drawer fronts, etc., also surfaced with plastics so that they will endure. Full details *Modern Plastics*, April, 1939. **New flooring** and wall covering material reported from Sweden. Suggested process consists of a mixture of latex and synthetic resin emulsion, cement and foam slag. **Moulded doors,** walls and like structural elements are now being made in America by hot pressing a mixture of a substantially major proportion of wood shavings or chippings with a small proportion of artificial resin. Coloured wood shavings or chippings may be used and the final moulding may be veneered. Reference should be made to B.P.497,320. **Transparent curtain rails** are the latest developments of the Dap Runesy Manufacturing Co., London, who have pioneered the extruded synthetic resin curtain rail. Further improvements reported in manufacture and claimed that new curtain rails are more flexible and completely silent in use, even with metal runners. Bending under heat is all that is now necessary to make a

permanent curve in the rail. **Graphited resin** paint described in recent French patent, 826,276, is made by mixing natural or artificial graphite with polymerized synthetic resin. The resin can be made after condensation and dehydration into a solution or varnish by dissolving in aromatic hydrocarbons or other organic solvents. By this means a fluid graphite or a graphited glue can be obtained. These in turn can be mixed with a solution of rubber. The film so formed possesses high resistance and elasticity at elevated temperature and, moreover, is not attacked by gases and solvents. **New primer** for wood suggested in an article in a Russian paper *Prom. Organ. Khim.* It is made from casein.

AIRCRAFT

Petrol tanks able to reduce risk of fire through leakage of spirit now being made of metal covered with gas-expanded rubber. Semape, Ltd., 4, Elstree Way, Boreham Wood, now making tanks in this way and claim them to be virtually bullet proof. In America the Bendix Aviation Company and the Atlas Corporation combining to produce tanks and wings with impregnated wood. Reported that the Haskelite Corporation, subsidiary of Bakelite Corporation, also engaged in the preparation of plans for similar work. **Laminated plastics** have been manufactured in the laboratory with tensile strengths up to 40,000 lb. per sq. in., but these not yet available commercially. On a strength/weight ratio basis, laminated materials compare favourably with wood and metals, as is shown in the following table, which gives actual strengths of standard materials divided by their specific gravity :—

In Tension

Stainless steel	23,600 lb. per sq in.
Magnesium alloy	25,400 ,, ,, ,, ,,
Aircraft spruce	23,300 ,, ,, ,, ,,
Bakelite cord filler	22,200 ,, ,, ,, ,,

In Compression

Stainless steel	19,100 lb. per sq. in.
Magnesium alloy	19,300 ,, ,, ,, ,,
Aircraft spruce	11,600 ,, ,, ,, ,,
Bakelite cord filler	20,100 ,, ,, ,, ,,

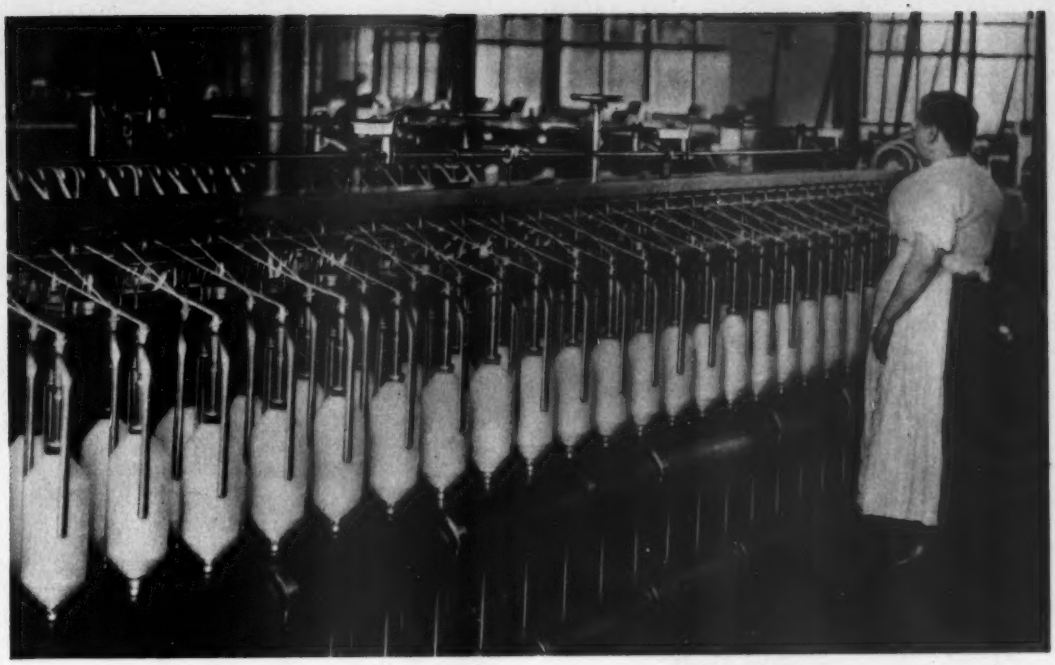
Bakelite laminated material at present available has a modulus of elasticity figure roughly the same as for aircraft spruce, but distinctly inferior to magnesium alloy and stainless steel. Under laboratory conditions, however, plastics have been produced with an elasticity comparable with magnesium alloy and it is merely a question of time before the laboratory material becomes a commercial product. Information from lecture by Messrs. George Dring and C. D. Philippe (Bakelite, Ltd.), Royal Aeronautical Society, 9/3/39. **Aerial masts** of Bakelite laminated material have now been approved by the Royal Aircraft Establishment, Farnborough, to be used as emergency masts in case of forced landings. The masts are collapsible and may be stored in a small space; also very light. **Glider construction** may soon require plastic materials. In the March issue of *Modern Plastics* (U.S.A.), a good account is given of the "plastic aeroplane." Mention made of thin veneers bound with synthetic resins without real impregnation and the use of improved wood produced by impregnation under vacuum, etc., followed by cohesion under pressure. The Hart-Still and Atwood methods of wing construction (latter using cellulose acetate) are described. **"Mareng Fuel Cells,"** by the Glenn L. Martin Co., of Baltimore, Maryland, described in April issue of *Rubber Age*, U.S.A. The fuel cell of tank is made of lightweight fabric coated with neoprene. Gasoline in the tank does not touch metal since it is in contact only with neoprene coating, although the fabric bag is partly enclosed in a metal structure. The structure of the wings, fuselage or float of an aeroplane afford compartments in which the fabric cells are installed. Instead of fitting these compartments exactly, the cells are designed in every case to be slightly larger in each dimension than the walls and under surfaces against which they rest. Because of this over-sizing factor, the impregnated fabric is never subject to stretching or twisting, but serves solely as a static, vibration-proof container, all strains and stresses being taken by the surrounding structure of the wing, fuselage or float. The new construction also eliminates the danger of corrosion. Another advantage of the neoprene-coated fabric cell or tank is rapidity and ease of repair work. Piercing of the treated fabric leaves a slit instead of usual hole.

TEXTILES

Casein threads, films and ribbons can, according to new German Patent 659,655, be made from casein and acid derived from casein. The raw material, casein acid, is dissolved in an alkaline solution to which is added a quantity of carbon bisulphide. This mixture is, when properly ripened, extruded in thread or ribbon form, washed, dried and hardened, taking care to avoid all shrinkage. **Casein textiles** were discussed by the Milk Federation of Frise (Holland) at a recent conference. The question was raised why the co-operatives did not take greater advantage of the possibilities. It had been left to private persons to take the matter up on a commercial scale. Members pointed out that, in spite of the fact that casein wool was being manufactured with full Government support in the totalitarian countries, the finished yarn stood in great need of improvement before it could compete successfully with natural wool. **Russian rayon** manufacture is now assuming considerable proportions. In pre-war days there was only one artificial silk factory with a total output of 100 tons a year. To-day there are four large factories and several small experimental plants situated in Mytischtschi, Klim, Mohilev, Leningrad. These are all producing viscose rayon, the estimated production now reaching the 8,000 tons a year mark. There are several other artificial silk factories under construction, one at Kiew, one at Stalingrad and one at Kamensk. Plans also laid down for more factories, one near Moscow, one at Perm and others in the Tartar Republic. **Filter cloth** is now made in Germany by the I. G. Farben Industrie from textile threads made of a chlorinated-vinyl resin. It is stated to be extremely resistant to acids and other corrosive liquids and is used for chemical work and as diaphragms in electrolysis. Judging from their composition, the fabric should also possess resistance to fire.

FANCY GOODS

Hollow bodies can, it is claimed by B.P. 495,318, be made by coating a core of glass, metal, wood, synthetic resin and rubber, etc., with a cellulose plastic, such as acetylcellulose. Prior to coating by immersion or other means in the plastic, the hollow plastic body is coated with gelatin or glue, preferably with added glycerol and sugar, to impart increased lubricating properties. After the hollow plastic body has shrunk on to the core, the assembly is heated to 40 degrees centigrade in the presence of water, when the gelatine coating softens and the hollow article is easily removable. **Elastic articles** made from polyvinyl alcohols likely to find new applications in fancy goods trade. A recent patent, B.P. 493,561, states that a mixture of polyvinyl alcohol and glycerol is suitable for injection moulding.



THE TEXTILE INDUSTRY NEEDS PLASTICS

Typical examples of cones and pirns made of laminated fabric and paper. Materials manufactured by Bakelite, Ltd.

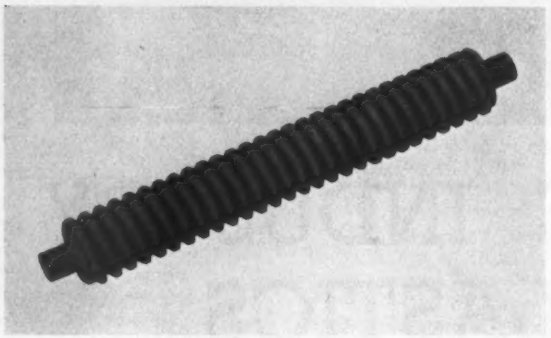
Synthetic fibres, such as viscose, cellulose acetate, Lanital and nylon; pirns, temple rollers, sliver guides, gear wheels, bearings and tenter frames, etc., made of laminated plastic material and a wide selection of bobbins, spinning pots, etc., moulded of phenol-formaldehyde powder—these are the most important contributions made by plastics to the textile industry

Guide pulleys for textile industry made of Tufnol by Ellison Insulations, Ltd.

IN this survey of the role played by plastics in the textile industry it is convenient to divide the article into two main parts. The first deals with the use of synthetic organic materials for producing the raw fibre for spinning and weaving, also the treatment of fabrics with water soluble resins to increase their resistance to creasing; the second part describes the new applications now being found for plastics in the manufacture of bobbins, picking sticks, bearings and other important parts of the spinning and weaving machinery.

There are two general classes of synthetic fibres, namely, those derived from cellulose and those from protein material. In the first category come viscose rayon and acetate artificial silk, and in the second the more recent fibres, such as Lanital, produced from casein and nylon from more complex protein groups.

The pioneer of artificial silk was Comte Hilaire de Chardonnet, who, after 30 years' intensive research on collodin, took out his first patent for producing fibres from nitro-cellulose in 1884-85, and commenced operations in a little town in Northern France in 1889. The so-called Chardonnet silk was followed by viscose rayon, which was discovered by two English chemists, C. F. Cross and E. J. Bevan, in 1892, and in 1903-4 Messrs. Courtaulds and the Société Francaise de la Viscose commenced manufacturing. Cross and Bevan were also responsible for the first practical industrial process for manufacturing acetate silk, and their patents go back to 1895. Decades passed, however, before developments warranted manufacturing cellulose acetate on a really extensive scale. Meanwhile the aviation industry had developed, and with it came the need for a "dope" for use on the fabric-covered wings of aeroplanes. Although nitro-cellulose preparations were widely used, and are, in fact, used to-day, there was a call during the War years for more fire-resistant dopes, and to meet this



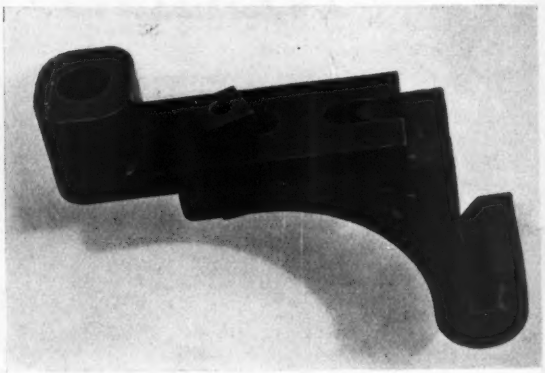
Tufnol temple roller widely used in modern mills in place of rubber and metal.

cellulose acetate was manufactured on a considerable scale. At the end of the War manufacturers of cellulose acetate had to find some other outlet for their products in a different field. Chemical research pointed the way through the production of cellulose acetate for the rayon industry, and later in sheet and powder form for the plastics industry.

Lanital, the so-called synthetic wool, has been given a lot of publicity recently, but it has now proved its real worth in the textile industry, and such great improvements have been made in its manufacture that to-day it is 85 per cent. as strong as natural wool. The first fibres were produced by dissolving dry casein in a dilute solution of caustic soda and spinning the liquid. The fibres were, however, hard, brittle and of no commercial use at all. It was primarily due to the efforts of Dr. Antonio Ferretti, an Italian chemist, that they were improved and made suitable for use in the textile mill along with other fibres. In 1935 the Italian rayon company, Snia Viscosa, commenced to produce Ferretti's improved fibre and it was called "Lanital," meaning "Italian wool." Since that time licences to manufacture have been taken out in a dozen or so different countries. In principle the production of Lanital is very simple. The casein is dissolved in an alkaline solution said to contain carbon disulphide. The viscous liquid formed is extruded to form fine threads, and these are passed through a bath of sulphuric acid, washed, dried and finally cured in formaldehyde solution. According to Suttermeister and Browne, in their recently published book on "Casein," one pound of casein yields one pound of Lanital. It can be cut to any staple, 4½ ins. being the average, as compared with 6 ins. to 7 ins. for wool; and the fibres can be spun to the finest counts.

Nylon is an entirely new synthetic protein product, having great strength, toughness and elasticity. It is at present made solely in America by Du Pont de Nemours Inc., who have recently started on the construction of a new plant at Seaford, Delaware, which, it is estimated, will cost $8,000,000. In addition, over $2,000,000 will be expended at Belle, West Virginia, for construction of plant facilities to manufacture the intermediate materials. The commercial application of nylon has so far been confined to the production of "Exton" bristles for use in toothbrush manufacture. These bristles are fully equal to the best natural product in general properties, and considerably surpass it in durability. The exceptional strength and elasticity of nylon when drawn into fine filaments, and its similarity to natural silk in appearance and utility, are expected to create a demand for it in the field of women's hosiery and sewing thread.

This important new plastic was discovered by Dr. Wallace Hume Carothers, the inventor of neoprene, who, unfortunately, has not lived to see his brilliant research exploited on a commercial scale. Nylon is produced from cadaverine, a complex protein material found in decayed meat, fish and other natural proteins, but now produced synthetically by Du Pont from the by-products of coal tar distillation. Castor oil also enters into the production of the new fibre because it is used to form an acid, sebacic acid, which is reacted with cadaverine. Full details are not yet available regarding the many steps in the production of this



Tufnol bracket supports a funnel in an artificial silk factory.

highly complex material, but there is no doubt that they have been successfully worked out and that nylon has definitely come to stay. It is interesting to note that, by arrangement with Du Pont, the production of nylon will shortly be taken up in this country on a considerable scale.

During recent years great progress has been made in the use of water soluble resins for treating cotton and linen fabrics, etc., to increase their resistance to creasing and also for processing rayon fabrics to reduce the undesirable tendency of the warp and weft threads in such materials to slip. A solution of urea resin, 10 to 15 per cent., is used in the process elaborated by Tootal Broadhurst and Lee for increasing the resistance of cotton goods to creasing. It has been found that this new plastic also improves the fastness of dyed textiles to washing and soap. Cotton is immersed in a boiling

bath of dye containing salt. It is then rinsed, dried and then immersed at room temperature in a 15 per cent. aqueous solution of urea resin, pressed until it retains only its own weight of liquor, then dried and finally heated at 165 degrees Centigrade for a period of two minutes. This increased fastness may be attributed rather to a physical than to a chemical cause. The resin formed after the dye is applied becomes more firmly attached and insoluble on heating, making the dye also substantially fixed to the fibre.

Recent research appears to indicate that the acrylic resins are likely to find important applications in the textile industries. Aqueous dispersions of the softer resins are the most promising for impregnating textile fibres, as the extremely thin film has a high resistance to heat, withstanding temperatures in excess of 300 degrees F. without discoloration. The treatment of dyed fabric with a suitable solution of acrylic resins greatly enhances the colour and gloss of the material, and this method has already been exploited to produce a permanently glazed chintz.

When considering the applications of synthetic resins in the textile industry it is important to remember that by their use it is possible to modify all existing fabrics. Thus rayon can be made to look and feel like genuine silk, and the conversion of a cotton suiting to resin modified wool-like garment is now a distinct possibility. By increasing elasticity and lustre, by decreasing shrinkage and slippage, by increasing strength and decreasing wear, the use of resin in textiles is amply justified, and a new field for resin application is opening, which promises to be one of its largest applications.

Oil Soluble Resins

As mentioned at the commencement of this article, plastics are finding many important applications in textile mills for plant and equipment used in spinning and weaving. Bakelite, made by the Bakelite Co., Ltd., Hobart House, Grosvenor Place, London, S.W.1, is, for instance, applied in one of four forms—as resins for the production of chemical resistant paints, as varnishes for impregnating wood, as laminated sheet, rod and tube, and finally as mouldings. Paints based on Bakelite oil soluble resins are used in bleaching works, dye houses and similar premises to protect steel and other framework from corrosion, due to humidity, acid and alkali fumes. It has been established by tests that paints based on these resinoids can resist immersion in a 5 per cent. solution of caustic soda for quite a long period, while normal finishes are completely eaten away in a few hours.

Bakelite varnishes are widely used for impregnating wooden bobbins employed for wet doubling, steam conditioning, flax spinning, etc. The varnish is also used for the treatment of dye poles and similar articles. To protect aluminium spinning pots and aluminium spools used in artificial silk manufacture against corrosion it is customary to coat them with Bakelite varnish.

Bakelized Fabric and Paper

Important applications in the artificial silk industry are being found for plastics, particularly laminated materials and Tufnol cellulose conveyor plates, chlorine gas tubes, chemical vat linings, spool holders, etc., are extensively used. Bakelized paper tubes and pirns are also used for yarn-conditioning and dyeing, while the fabric type of laminated material is extensively employed for stenter openers on stenter machines, in place of metal. The use of plastics in this instance enables a considerable reduction to be made in the amount of wear on the clips and the opener. Shuttle driving racks and various types of guide pulleys for looms are also made of laminated materials, such as those made by Bakelite, Ltd., and Ellison Insulations, Ltd., who manufacture Tufnol. Temple rollers, previously made of rubber and metal, are now being made of Tufnol, as they are unaffected by the humidity of the mill and do not stain the threads. Sliver guides, cut from Bakelite laminated material, are used for replacing metal and celluloid in connection with cotton spinning, the advantages being that the material does not corrode, is not subject to distortion to the same extent as celluloid, and is fire resistant. This laminated material possesses an exceptionally high degree of mechanical strength and can be used for the production of gears transmitting up to 300 h.p. Such gears are extremely silent in operation, while also incorporating the chemical resistant properties inherent in the material. There is undoubtedly a wide field of use for gears of this nature in the textile industry. Tufnol gear wheels, because of their smooth and quiet running, are in regular use on many loom drives in cotton, silk and carpet mills, and are particularly useful.

Important New Application

In the finishing of cloth the last major operation is "tentering," which really consists of stretching the material lengthwise, naturally decreasing the width, after which the tenter-frame resets the cloth to the desired width. The tenter-frame, the rails of which are usually made of hard maple, consists of two almost parallel endless chains, made up of clips which seize the salvage of the moistened cloth at the entering end and carry it, under tension, to the leaving end of the tenter. In the old style or "open" frames, gas flames under the cloth supplied heat for drying and "setting" to the desired width.

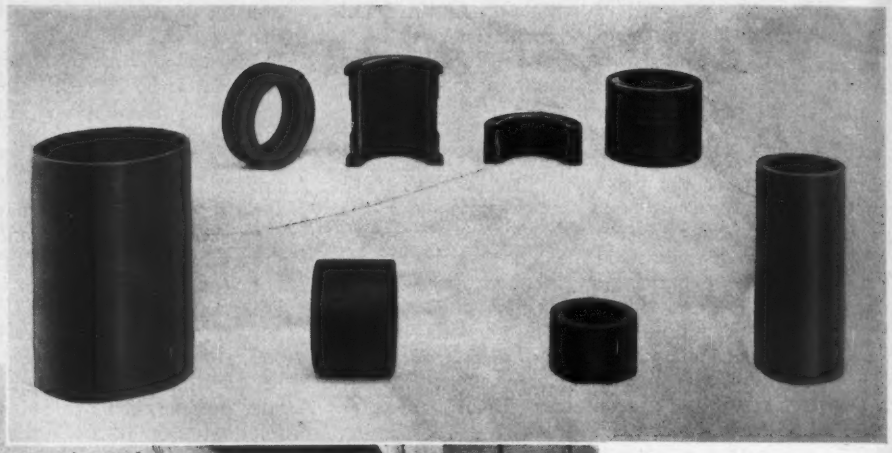
Owing to the high temperature and humidity of the tenter room it is obvious that even the finest maple wood will not be able to resist warping and buckling, and this constant replacement every three or four weeks has been for years a constant source of worry. To overcome this difficulty use has now been made of laminated material, which not only cuts out all maintenance, but enables the temperature of the room to be raised to 350 degrees Fahrenheit without suffering any deterioration. There is no doubt that the use of impregnated fabric material for this purpose is very definitely saving the textile manufacturer both money and time, because, by increasing the temperature of the tenter room, he can ensure a proportional increase in cloth speed.

Advantages of Laminated Materials

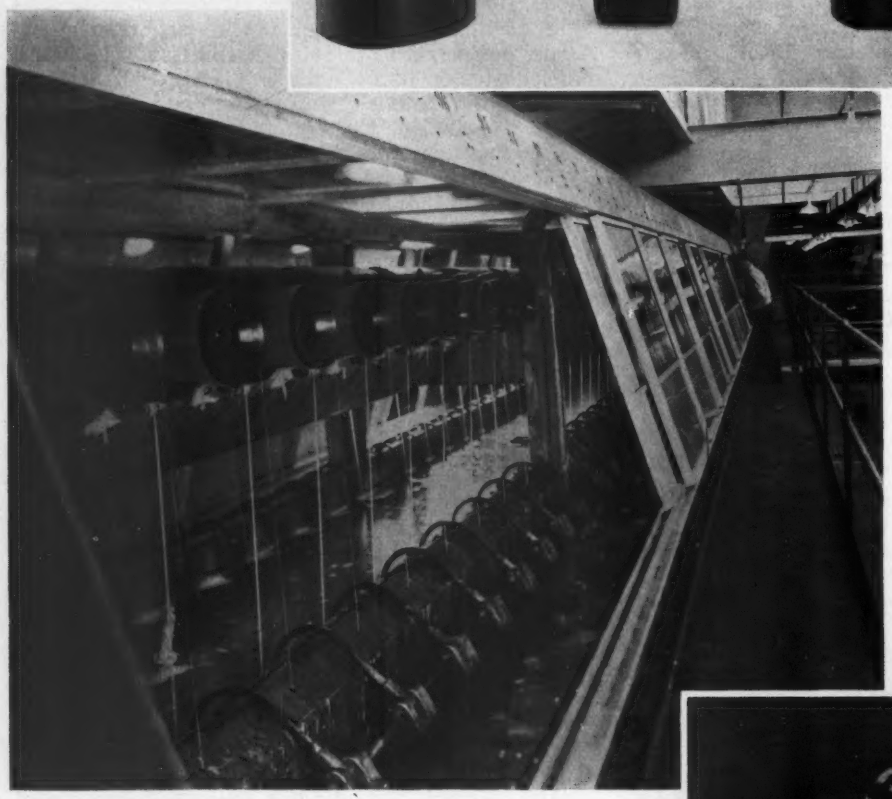
The main advantages of laminated fabric and paper for use in the textile industry are:—

(1) Non-corrosiveness, even when subjected to certain important acidic liquors. This prevents any risk of staining fabric with which the material comes in contact.
(2) Smooth surfaces which will not damage fabrics with which they come in contact.
(3) The materials also have the desirable properties of electrical insulation, heat insulation, high mechanical strength under steady loading and impact condition, lightness, durability, non-corrosiveness, resilience and valuable anti-fretting properties.

The numerous grades of laminated materials made by the Bushing Company, Ltd., Hebburn on-Tyne, are now

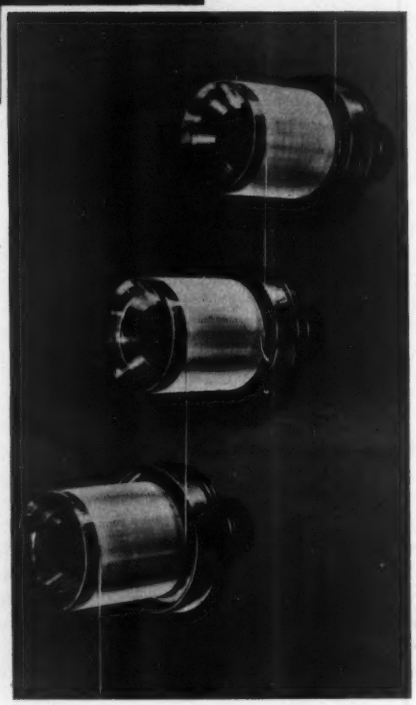


Group of tubes and bearings made by the Bushing Company, Ltd., Hebburn-on Tyne.



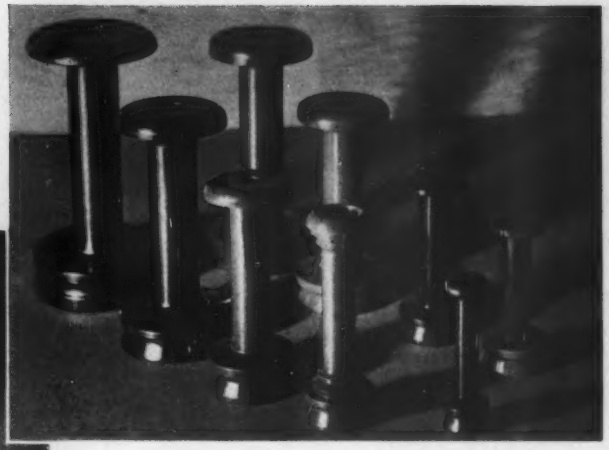
Part of the new viscose plant made by Rayon Machinery Corp., U.S.A., showing moulded reels in the centre of the picture.

This photograph shows continuous production travel of thread from one plastic reel to the next during processing.



finding many applications in cotton mills, etc., particularly for guide rollers which are not liable to corrode or stain. Alternatively, metal rollers may be covered with bakelized fabric Texolex or Tynolex paper. The latter has been successfully applied to such articles as mandrels, reels and pirns. Texolex bakelized fabric is a valuable material for bearings. Graphited varieties may be used dry for light bearings; for other cases water is the best cooling and lubricating medium, and in many cases it is an advantage to have such a bearing material which is able to operate successfully in water. Special grades of bakelized asbestos are now being used for piping and fittings for corrosive liquids.

Mouldings are to-day finding many important applications in the manufacture of artificial silk, particularly viscose rayon yarn. In the conventional "pot-spinning" (centrifugal) machine viscose is forced under pressure through jets submerged in an acid bath. Each jet has from 40 to 90 microscopic holes through which the viscose is extruded, each hole producing a distinct stream of viscose which immediately coagulates upon contact with the acid, forming a tiny filament of



Moulded bobbins for jute and flax yarns made by Kent Mouldings.

Cotton and jute bobbins moulded of phenol-formaldehyde resin by Kent Mouldings.

yarn. The coagulated yarn is drawn away from the jet and fed into the inside of an acid-resisting plastic spinning pot that rotates at a speed of 8,000 to 10,000 r.p.m. The centrifugal force exerted by the yarn against the walls of the revolving pot causes the yarn to build up in the form of an annular ring, known in the industry as a "cake." The rate of feed of the yarn into the pot, in conjunction with the high rotating speed of the pot, causes a twist of 2½ to 3 turns to the inch to be put into the yarn.

In spool spinning the viscose filaments are carried through thread guides mounted on a transverse mechanism, and are laid evenly on a revolving spool, controlled by a differential speed device to compensate for the increased package diameter as the yarn builds up on the spool, so as to produce finished yarn of predetermined uniform weight per unit of length.

The spool upon which the yarn is wound is usually made of perforated aluminium, coated with an acid-resisting plastic paint.

Both these methods have definite limitations. If the freshly spun yarn is permitted to dry when restricted in cakes or on spools, it will develop inequalities in its properties, depending upon strains to which the yarn is subjected. Further, yarn in any such bundle or package is subject to varying intensity of treatment, both chemical and physical, depending upon which part of the yarn is more exposed. Such irregularities are minimized by reeling the wet yarn into skeins which, through a series of costly time-consuming successive operations, are processed and dried in a loose and free condition, eventually to be wound as a cone of finished, bleached and twisted yarn ready for the market.

In the spool system, unlike the centrifugal process, twisting does not take place coincidental with spinning. Therefore, some form of equipment for twisting as a separate operation is necessary.

The new process combines into one continuous series of operations all steps from spinning to drying and twisting the yarn on bobbins, accomplished by building into one complete machine a spinning unit equipped with continuous Richardson moulded plastic reels made of Durez phenolic resin, a "stepped" inclined processing panel also equipped with continuous plastic reels of which the yarn is chemically treated, washed and dried as it travels from one reel to another down a vertical run; finally to the bobbin. Thus there is no handling of the yarn from the time the viscose is forced through the jet until it is all wound up on the bobbin, ready for transfer to the coning room. All operations are continuous and automatic, so that the finished yarn possesses a uniformity of fineness and physical characteristics that could not be guaranteed under the old, orthodox methods. And all this has been expedited by the development of plastic reel members on which the yarn is advanced at an accurate predetermined speed through all the processing stages. These reels are the handling medium for the continuous viscose rayon process.

The importance of precision in the moulding can best be appreciated by realization of the fact that any variation from the exacting tolerances specified would affect the speed of travel of the thread and its ultimate denier (diameter or gauge). The spinning reels, which are located above the spin bath and draw the gummy filaments up from the bath, for instance, have a stretching function which demands extreme accuracy. Designed as modified cones which flare outward from the driving axis, these reels stretch the yarn as it moves forward in successive wraps of increasing diameter. Dropping directly down from the reel at the discharge end of the spinning reels the threads of yarn pass down through individual tubes to the processing level where each strand passes over a sequence of eight additional cylindrical reels of the same composite plastic structure. At the base of this processing section, in which desulphurizing, bleaching, oiling and intermediate washing operations take place, each thread moves on to an aluminium drying reel of similar construction through which hot water circulates, and finally to the plastic bobbins at the base of the machine.

Owing to their many advantages for use in the textile industries, moulded bobbins are now rapidly replacing

wooden bobbins. The former are considerably stronger than wooden bobbins and, consequently, are not so liable to break during the heavy service demanded in modern mills. This feature is of the utmost importance when it is borne in mind that if a bobbin breaks the yarn wound on it becomes useless.

By using moulded materials of various colours, coloured bobbins can be produced if mills desire to make use of a "Colour Code" system in connection with the spinning of different yarns.

It is interesting to note that moulded bobbins, apart from being used extensively in Northern Ireland and elsewhere for flax spinning, are now being used in jute mills in the United Kingdom and abroad. Moulded pirns are also being used for cotton spinning. Kent Mouldings, Sidcup, Kent, specialize in moulded bobbins for all branches of the textile industry.

Besides mouldings made from powder and pressed shapes from laminated material, impregnated wood is now being fairly extensively used, especially for picking sticks. In ordinary practice these have to be constantly renewed and cause both inconvenience and loss of time. Experience has shown that when made of impregnated wood their life is prolonged indefinitely. Special blocks are provided to accommodate the production of two sticks from each block. For shuttles, the normal grades of laminated wood are too heavy, but there are now available special grades of impregnated wood, which have the same excellent wear-resisting properties. Friction rollers, pulleys and bearings for heavy loads are also being made of impregnated wood and fulfil all practical requirements.

There are at the present time two kinds of impregnated wood. The first is an English product known as Jicwood and manufactured at Weybridge by Jicwood, Ltd., a subsidiary company of the Airscrew Co. The latest figures relating to the strength of Jicwood are:—

Tensile strength ...	47,800 lb. per sq. in.
Shear	7,400 lb. per sq. in. (along grain)
Compression ...	26,500 lb. per sq. in.
Density	85.6 lb./ft³
Modulus of elasticity	4-4.5 × 10^6
Impact-Izod ...	13.6

The second type of impregnated wood is known as Durisol. This is a French product made in Beauchamp by the Société des Etablissements Cadoux, and handled in this country by Textile Accessories, Ltd., Sunderland Street Works, Macclesfield. Durisol consists of laminations of hardwood disposed either in parallel or cross sections. The three qualities in demand are:—

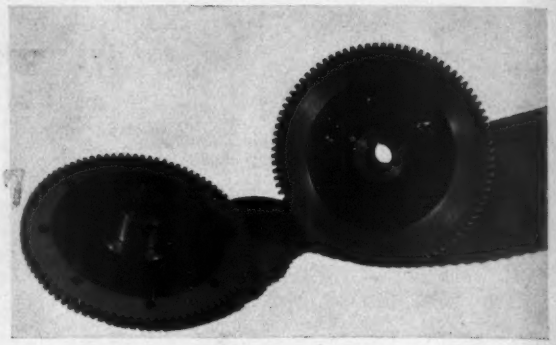
P.S. Quality.—Layers in parallel. This is recommended where great resistance to traction and flexion is demanded, such as electric work, flooring, cog wheels.

C.S. Quality.—Layers assembled at 90 degrees. Special uses of this grade include friction rollers, pulleys and bearings for heavy loads, etc.

E.S. Quality.—Layers assembled at 45 degrees. This quality provides practically equal resistance in all directions.

Durisol can be assembled with wood or metal screws, but definitely resists nails. Glue may be used in its cold state, and no difficulty is experienced in handling the material on ordinary wood or metal-working machines. High-speed tool steel should, however, be used for the best and most economical results.

Apart from the use of impregnated wood and compressed wood, the latter finding particular application for large industrial fans in textile mills, plastics find other applications in bleaching, dyeing and finishing works. Such materials as Haveg, an acid-resisting asbestos-filled resin, are now being considered by manufacturers. Large tanks can be built up from pressed sheet, and all kinds of pipes and fittings may be moulded of this special phenolic resin.



Two Tufnol loom gears made by Ellison Insulations, Ltd.

Firms Mentioned who Provide Plastics for Textile Machinery

Bakelite, Ltd., 40, Grosvenor Place, London, S.W.1.	Bakelite varnish. Laminated materials for pirns, tubes, sliver guides, gear wheels, bearings, etc. Bakelite moulding powder for bobbins, spinning pots, etc.
Ellison Insulations, Ltd., Perry Barr, Birmingham, 20	Laminated material, Tufnol, for all purposes, such as temple rollers, guide pulleys, shuttle driving racks, etc.
The Bushing Co., Ltd., Hebburn-on-Tyne	Texolex Bakelized fabric for bearings, guide rollers. Also make Tynolex Bakelized paper and Bakelized asbestos fabric for acid-resisting uses.
Birkbys, Ltd., Liversedge, Yorkshire	Moulders of Elo range of goods for use in textile industry. Also Elo varnish.
Kent Mouldings, Cray Works, Sidcup, Kent	Moulders of bobbins and pirns for use in cotton, jute and flax mills.
Jicwood, Ltd., Weybridge, Surrey	Manufacturers of impregnated wood for picking sticks, etc.
Société des Etablissements Cadoux de Beauchamp	Manufacturers of Durisol, well-known Continental impregnated wood, used for picking sticks, bearings, etc.

COMPETITION

is keen, especially in the plastics trade. To hold his own the moulder must choose the best and most economical material for every job. Nowadays selection is made more difficult by the development of many new types for each of which special properties are claimed. We supply the widest range of plastic materials on the market, and can therefore give you really helpful advice and technical assistance.

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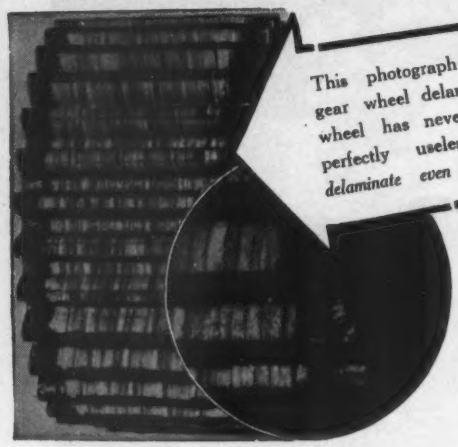
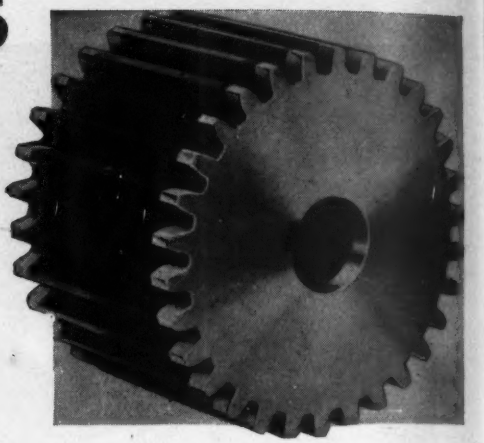
TUFNOL GEARS CAN BE STORED INDEFINITELY !



This photograph shows how a non-metallic gear wheel delaminated whilst in store. The wheel has never been used and yet is now perfectly useless. *Tufnol gears will not delaminate even if they are stored for years!*

SOME OF THE ADVANTAGES OF TUFNOL

Half the weight of aluminium. Tensile strength ranging from 3½ to 7¼ tons per sq. in. according to brand. Non-metallic. Grade 1 electrical insulator. Unaffected by oil, petrol, most acids, alkalies, chemical fumes and excessive cold. Resilient. Non-brittle. Can be machined like metal.



A gear wheel made of Tufnol. Tufnol can be supplied either in sheets or blanks, or complete wheels can be supplied to almost any desired size, from large gears for heavy machinery down to minute gears used for clocks and instruments.

An interesting book has been issued containing general information and technical data on TUFNOL. A copy will gladly be sent to you on application to:

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PERRY BARR, BIRMINGHAM, 22.

104

CELLULOSE ACETATE & POLYSTYRENE RESIN

RHODOID Cellulose acetate sheet, rod, tube and thread

NACROLAQUE Mother of pearl

RHODIALINE Transparent material 2/10 to 10/10 mm. in continuous reels

RHODOPHANE Thin film in reels or sheets

RHODIALITE Cellulose acetate moulding powder

RHODOLENE Polystyrene resin with outstanding electrical properties

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This photograph shows the New York City Building with the Trylon and the Perisphere in the background at the New York World Fair due to open this month. Incidentally, a good deal of publicity is to be devoted to Neoprene in the technical pavilions.

★

Buna rubber will soon be manufactured in the United States, and it is anticipated that the American I.G. Chemical Corporation, or one of its subsidiaries, will put up a special plant. An expanding market has been created for Thiokol and Neoprene and the present war scare in Europe is causing manufacturers in America to take a lively interest in home-produced rubber. A considerable volume of business is also being done with the war departments, who appreciate the special qualities of synthetic rubber for petrol hose, gaskets and other important applications in mechanized transport and military aviation.

★

Rubber has now gone to the dogs, inasmuch as it is now being used for making special safety hurdles, so that expensive greyhounds will not risk suffering any injuries when taking the jump. The new safety hurdles are in regular use at Owlerton track and apparently meet with the enthusiastic approval of both dogs and trainers.

★

A recent patent, B.P.499,625, taken out by the United States Rubber Products, Inc., describes an ingenious method of making rubber labels. These can be produced by imprinting a plate of thin aluminium so as to form recesses and then coating this with rubber ink of such consistency that it does not enter the recesses. Then, by applying a layer of plastic rubber of contrasting colour and exercising sufficient pressure to make the backing enter the recesses and cohere with the ink, a satisfactory coloured label is produced. This may be vulcanized and stripped from the plate and cemented to any desired surface.

★

According to the *Manchester Guardian Commercial*, April 6, rubber number plates have now been passed by Scotland Yard and will shortly be seen on the road. The plates, the index figures and the letters are made of a specially hardened rubber stock which has a certain flexibility. Among the advantages claimed for such plates over the usual kind are that they do not rattle, buckle, crack or go rusty. Moreover, in the event of a slight knock they are not as easily damaged as the metal plates. A further claim for them is that they are more advantageous at night, since they eliminate the dazzle sometimes caused by the reflection from metal numbers in a car's head light.

★

The growing importance of the Indian rubber industry is stressed by Dr. J. Matthai, Director-General of Commercial Intelligence and Statistics, writing in the April number of the Trade and Engineering Supplement of *The Times*. He states that the marked growth of the manufacture of rubber goods in India during the past five years is due to the increased production of motor tyres and also to the increased use of rubber in the manufacture of footwear. India has always been an exporting country in raw rubber, but recently there has also been a striking advance in the internal consumption. An approximate calculation shows that in 1929-30 the quantity of dry rubber retained for consumption in India was under 700 tons, but in 1937-38 the figure rose to over 7,000 tons. Although the production of rubber in India has nearly doubled since 1929, the rubber factories in Calcutta have been obtaining their supplies of raw rubber partially from Burma. The imports of rubber from Burma were negligible five years ago, but the latest figures show an annual import of nearly 3,000 tons.

★

"Cable cancer," due to the corrosion of the lead sheathing through the action of chemicals as well as electrolysis, is a disease only too well known in the cable industry, and until the present time there was no certain cure. To-day, however, it is claimed that cable cancer can be abolished, and the Okonite Co. of America are responsible for a good deal of the research which has been carried out during the past few years. The following particulars regarding one industrial concern's experience has been supplied to us by the Okonite Co., Passaic, N.J., and it illustrates how completely "cable cancer" has been abolished and why manufacturers everywhere are now showing a keen desire for non-metallic covered cables, particularly for installations encountering oil, grease and chemicals.

"Of particular interest are the Thiokol-protected cables furnished to one large industrial plant during the past two years. They were purchased to replace lead-covered distribution cables that had been installed in wooden or fibre trunking, with the duct lines and manholes partially, or, in some cases, completely, filled with water. In addition to appreciable amounts of waste machine oil, the water was contaminated with chemicals and other industrial refuse from nearby canneries, packing houses and a soap factory.

"Okolite insulated cables were able to replace both the rubber-insulated cables and 13,000-volt paper cables. These were then protected with two Thiokol tapes and a heavy saturated braid and installed as fast as the lead-covered cables failed. Not only have these Thiokol-protected cables functioned perfectly, but they have reduced the rate of failure from electrolysis of the remaining lead-covered cables, since the non-metallic coverings have apparently broken up the path for direct currents which were travelling along the lead sheaths." Particulars regarding the use of Thiokol in industry may be obtained on application to Thiokol Corp., 37, Down Street, Yardville, N.J., U.S.A.

PLASTIC MOULDINGS

Plastics and metal diecastings are often in opposite camps. The author describes the merits of both and the necessity for examining them before making a choice

WHENEVER the means is appropriate, the tendency in engineering planning to-day is to secure a component in one process, either by moulding or diecasting, rather than fashioning it from raw material stock through several fabrication operations. The object of this is not merely the monetary saving from labour eliminated, but also the time factor, speed of production being greatly enhanced. Let it not be thought, however, that all factory operations are saved thereby, because often mouldings have to undergo drilling, tapping, milling or other simple machining processes, while diecastings additionally demand in general "finishing" for protection or adornment. The rapidity with which components produced by these two processes are being adopted by the engineering industries has caused the choice between metal and plastic to become rather haphazard. There is a tendency for individual sections of industry to acquire a complex, and become either solely plastic or solely diecasting "minded," often to the detriment of themselves, the application of the product, and the moulding and diecasting industries. In consequence, some thoughts on this aspect of the subject are deemed opportune.

From the point of view of quantity production, the ordinarily recognized phenolic wood flour filled moulding and the zinc base pressure diecasting can be selected for the purpose in hand. Whatever features are illustrated with respect to these can to a greater or lesser extent be cited for the other representatives of the two spheres, acetate, amino, etc., on the one hand, tin, aluminium and magnesium base alloys on the other.

Plastics and Castings Compared

Fundamentally, the processes of plastic moulding and of metal diecasting are closely similar. Each consists in fashioning the article to the required shape in dies by means of heat and pressure. In plastic moulding, essentially the raw material is in the form of powder, and in most cases it is loaded into a heated die in powder or pellet form, and then subjected to the required pressure for a predetermined time. A slight modification of this process applies to some plastics of the thermoplastic type, whereby the powder is heated in an external chamber until it is in a viscous fluid state and is then injected into the mould under pressure. On the other hand, in metal diecasting, the metal is in the liquid state, from which condition in gravity diecasting it is ladled from the crucible and poured into the die, and in pressure diecasting it is forced direct into the die by hydraulic or pneumatic pressure. In moulding and in diecasting the moulds and dies are constructed on the same principle, each consisting of two or more parts. A further similarity exists in so far as inserts can be employed in both processes. Minor divergences worthy of note exist, however. With plastics, mould wear occurs from abrasion; with metal casting, die wear arises from erosion and from actual dissolution of the die metal. Again, working temperatures being much higher for diecasting, special alloy steels have to be employed to withstand the rigours of temperature and pressure without distortion. Hazards to the employee are potentially greater in diecasting, and necessitate, therefore, additional safeguards.

Production by both moulding and diecasting is very rapid, and quantities involved in any individual order must be sufficiently large to justify the expense of setting up. In each case there is an outlay for special tools, and this is likely to be a little higher for metal castings than for plastic mouldings, other things being equal.

Characteristics of Plastic Mouldings

The outstanding virtues of plastic mouldings as exemplified by the phenolics are as under:—

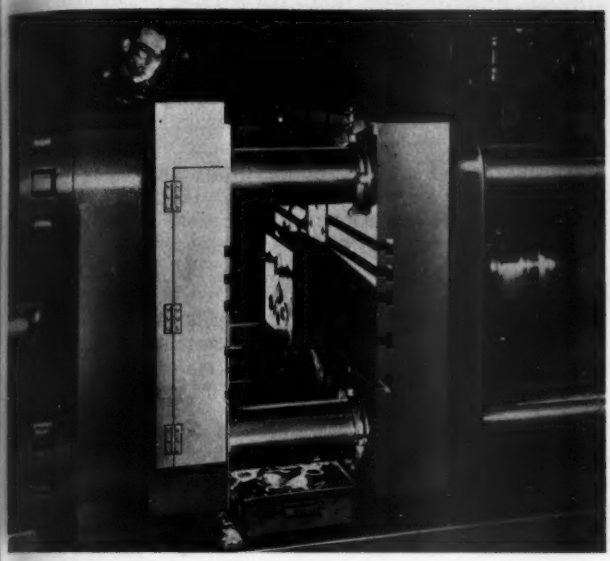
(1) Reproducibility of type and accuracy of dimensions within agreed limits. By co-operation with the moulder at the design stage, it is practicable to agree upon a datum to which all tolerances shall be referred, to stipulate important dimensions, and to arrange for those where latitude must be permitted to occur where they are of no moment.

(2) Provision of a "finish" on the article direct from the mould that can satisfactorily serve as the ultimate finish. Arrangements can be made at the design stage for flash marks to occur where they are of least significance, and it can be specified which flashes must be buffed off perfectly and which need only be dressed off.

(3) Provision of a range of colours or mottled effects by choice of powder used without change of tools.

(4) Provision of an article in a material which is

METAL DIECASTINGS?



by E. E. HALLS

virtually stable and permanent, and non-corrodible under all conditions with the exception of specific purely chemical conditions.

(5) The use of a basic raw material which permits of minor compositional changes, to improve still further specific characteristics of dimensional stability under conditions of severe dampness or prolonged heat, shock resistance, electrical performance, etc. Likewise, a range of materials of similar ultimate type is available to suit the intricacies of different designs.

(6) Provision of a non-metallic material having well-defined properties with respect to heat conductivity, electrical insulation, sound dampening and relative non-absorptiveness.

Characteristics of Diecastings

The metal products, exemplified by zinc alloy pressure diecastings, compare on these points in the following manner:—

(1) As far as reproducibility, dimensions and features of design are concerned, metal is on an equal basis with plastic. It might be mentioned that very fine threads and fine markings, such as raised characters or graduations, are superior in zinc.

(2) The finish on zinc castings can only serve the ultimate need where finish is of no consequence. For all intents and purposes, protective finishes of enamel or electro-plate, or decorative finishes by filling and enamelling or polishing and electroplating are indispensable. Incidentally, these processes provide their own peculiar problems, which are additional to those encountered in the finishing of the more common metals.

(3) Colour effects can only be secured by appropriate after-treatments in the metal fishing shop.

(4) As for plastics, virtual stability and permanence are secured, but the corrodibility aspect has to be taken care of with suitable finishing processes. (See 2.)

(5) Variations in specific properties by alloying elements can be secured, but in a more restricted sense than with plastics. A fairly wide range of alloys is available to facilitate the casting of articles of varying configuration.

(6) Where a non-metallic material is demanded, the metal castings in themselves are obviously out of the question; it must, however, be noted here that a combination of metal diecasting and plastic moulding has fulfilled some requirements more adequately than either alone could serve the purpose.

Instinctively one regards a metal as being mechanically stronger than a plastic moulding. In considering mechanical characteristics of diecastings in relation to mouldings, the weight/volume ratio must be taken into account. The tensile strength of castings is very much higher than for mouldings, but a useful picture of their respective merits can be gained by considering their strength/weight ratios. These can be taken as approximately 2.1 for moulded phenolic plastic, 7.1 for magnesium, 2.6 for zinc, and 3.3 for aluminium. It can be seen, therefore, that there is little to choose between a phenolic moulding and a zinc base diecasting in the matter of tensile strength with respect to weight.

In many applications of mouldings and diecastings the weight of the component is of paramount importance. When this is a deciding factor, then phenolic mouldings are to be preferred when other circumstances do not prevent their use. As far as weight is concerned, the order of merit is: phenolic mouldings, magnesium diecastings, aluminium diecastings and zinc base diecastings. It should be noted that the weight of magnesium is not very much greater than that of phenolic plastic mouldings, the density of magnesium being 1.8, compared to 1.4 for average-quality wood-floor base phenolic plastic mouldings.

Machining Operations

In numerous instances both plastic mouldings and metal diecastings have to be subjected to machining operations. This is an aspect which must not be overlooked when freedom of choice is permissible. Taking for comparison the two materials cited above, it must be realized that the phenolic mouldings are extremely abrasive from a machining point of view, rapidly dulling the tools and demanding special precautions during machining. For example, they are relatively brittle, and if heavy cuts are employed there is always the possibility of chipping the moulding at the commencement and end of the cutting traverse. Further, cuttings from

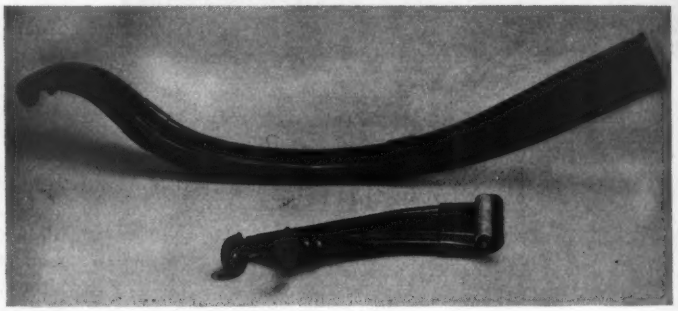
mouldings are powdery in nature, and in such operations as drilling and tapping the swarf is not readily cleared from the tool. Due to the heat engendered during cutting, there is always a tendency for the powdery swarf to bind in flutes, setting up high resistance to the cutting action of the tool. Moreover, when it is a question of tapping threads in mouldings extreme care has to be exercised, due to the brittle nature of the material, if clear-cut, well-defined, accurate threads are to be produced. From a machineability viewpoint metal castings are vastly superior to the mouldings, and can be readily machined by any of the recognized methods of fabrication. Castings in this connection suffer from one drawback, which is not found with mouldings. It is practically impossible to produce castings in the light metals without the probability of pinholes and blowholes being present. These are objectionable when they occur in areas which have to be drilled and tapped, and frequently are the cause of much scrap.

In considering the comparative cost of mouldings and diecastings, it should be borne in mind that there is no scrap value for the thermo-setting mouldings which may become damaged during assembly or otherwise discarded. No scrap value is obtainable for swarf from mouldings. Also, mouldings which may be rejected upon a supplier for defects, such as dimensional errors or chipped surfaces, cannot be used again.

On the other hand, the market value for swarf produced from castings or for broken or damaged castings is good. Again, castings which are rejected for various causes are available for the supplier to remelt and thus recover in the form of sound castings. From this angle less wastage exists with the use of diecastings.

To make the most efficient use of mouldings or castings a rational outlook must be maintained. In numerous applications mouldings or castings can be interchanged without any detriment to the product. Selection should be based upon the initial cost, availability, ease of subsequent fabrication processes, mechanical requirements, and the general requirements of the product. The combination of articles produced by these rapid production methods must not be overlooked. There is no inherent difficulty in producing a casting which can then be regarded as an insert for mouldings, and applying the plastic material to the form desired around or in the insert, as the case may be.

Developments in Plastic Sheet



A complicated shaping from cellulose acetate sheet—the conveyor for an ammunition belt.

THE Hadley Co., Ltd., as our readers already know, is one of the largest concerns producing spectacles in the country and, therefore, one of the largest users of cellulose acetate and similar plastics. Indeed, so important did we consider its factory at Surbiton, that we devoted considerable space to its description in our January, 1938, issue.

The knowledge gained by this company in the manipulation of plastic sheet of the acetate and similar type obviously makes the factory amenable for manufactures other than spectacle production, so that it is with little surprise we learn that, during the past year or so, the factory has been enlarged considerably to undertake the production of plastic goods necessary to the aircraft industry.

The Hadley Co. are now well established as producers of shaped plastic sheet for landing-lights and aeroplane windows.

Thus, in the first of the accompanying photographs, we see some of the already well-known plastic shapes now being made at Surbiton. These include landing light covers, leading-edge "windows," and so on. These are not particularly complicated, but their manufacture is of considerable importance and, moreover, entails considerable experience in manipulation.

One special type of manufacture for use in aeroplanes is, however, more complicated and very impressive. It is a chute for conveying ammunition belts from ammunition boxes to machine-guns. Cellulose acetate replaces metal here for several good reasons. Lightness is of paramount importance, and toughness, coupled with the ability to "give" slightly yet to withstand the heavy weight of a loaded belt, extremely desirable. Moreover, the readiness with which cellulose acetate can be shaped to take curves makes it eminently desirable for producing curved forms in restricted places.

As will be noted from the photograph of this conveyor, prolongations can easily be made. Flanges and ridges have been included during the shaping process to prevent "jumping" of the belt during its transit. Altogether, this is an excellent example of the plastic sheet-manipulator's art.

PRODUCTION

Practical Information dealing with Raw Materials, Moulding and Forming of all types of Plastics—Thermo-Hardening and Thermo-Plastic—Works-Organization, New Plant and Control Apparatus

NOTES AND COMMENTS

Injection Moulding Plant

WHEN injection moulding was first introduced, a few years ago, it was regarded with some dismay by certain sections of the moulding industry, although at the same time they recognized its obvious merits. It was asserted that, so rapid was the output that the orders were not there to make it pay, and that disaster was in store for those who made such capital outlay and were mesmerized by the miracle of the manufacture.

On general principles there is some basis for such a fear, since it is not considered a paying proposition to install a plant if the jobs are not there. And it certainly appeared possible that moulders would go through a hard time until a sufficient number of these jobs were obtained.

To-day many things point to the fact that the fear was, after all, unwarranted, or, at any rate, energy on the part of men has so far dissipated it. From all sides we hear of injection moulders chock-full of work and of more injection moulding machines being installed. The users of them deserve considerable credit for their courage. It is probable that they have realized to the full the potentialities of the machines and have gone full out getting jobs to be done on them. Naturally enough, this has been, in part, at the expense of the thermo-setting type of plastic, but there is plenty of evidence that this is far from being the full story. Many examples of objects that have never been attempted in plastics at all are appearing on the market made from thermo-plastic materials by injection, some even that it would be exceedingly difficult, if not impossible, to make from the thermo-setting resin. This progress will undoubtedly be maintained, since industrialists are realizing the saving made in processing by utilizing plastics in general. Only during the past month we have seen a transparent oil-can, made in two parts by Messrs. Fraser and Glass, utilizing the injection process. A famous razor-making firm is installing an automatic injection machine for producing their new electric shaver in thermo-plastic resin. Again, transparent plastic teat cups for milking cows are being produced by injection, the material being more advantageous than any other and the design reproducible more economically by injection. We mention these objects merely because of their variety. A hundred—or is it a thousand?—others are being so made.

Although it is difficult to see into the future, it is almost more difficult to be pessimistic about this special section of moulding. So much has been done in the little time it has been in existence.

Last month we hinted at a future re-orientation of the vast toy industries of the world. They will increasingly become engineering jobs capable of production in Slough or Salford. Injection moulding is a portent.

Kenneth Chance Scholarship For Art Designers.

Once again we have pleasure in giving publicity to this scholarship. It is open to Art Designers employed in any branch of the Plastic Industry. It is founded for the purpose of enabling the successful competitor to spend a further year in the study of art as applied to the production of factory-made wares.

The funds are provided by Messrs. British Industrial Plastics, Ltd., while the award and the general administration of the scholarship are in the hands of the Institute of the Plastic Industry. One scholarship is available annually of the value of £150 and is tenable at a school of art selected by the scholar and approved by the Institute.

The award will be made to the candidate who, in the opinion of the awarding committee, has the basic training, artistic ability, good personal record, and a practical experience in the industry necessary to make the best use of a further specialized year of study.

Those wishing to compete should communicate with the Hon. Secretary, The Institute of the Plastics Industry, Windsor House, Victoria Street, London, S.W.1, who will indicate the information required by the awarding committee. Selected candidates will be asked to meet the committee, but no award will be made unless there is a candidate who is considered to be sufficiently qualified.

The commencement of the next term of the Scholarship will be in the autumn, and applications will be considered which reach the Hon. Secretary on or before June 24, 1939.

Works Visit.

Messrs. Alfred Herbert, Ltd., of Coventry, have invited members of the Institute of Plastic Industry and others interested in the plastics industry generally, to visit their works on Wednesday, May 24, 1939. The tour of the works will commence at 11 a.m. and lunch will be provided.

Inquiries and Answers

Transparent Rubber

Edmonton, N.18.

The Editor, *Plastics*.

Dear Sir,—In the March issue of *Plastics* you described a material as Transparent Rubber, and we have been trying to obtain particulars of this from I.C.I., Ltd., but it would appear that the only material they can offer us is Neoprene. We shall be glad, therefore, if you could give us any further details regarding the illustration of Transparent Rubber that was shown in your periodical. LISSEN, LTD.

[EDITOR'S NOTE.—This material is made by E. I. Du Pont de Nemours and Co., Inc. (Wilmington, Delaware, U.S.A.). The London address of this firm is Bush House, Aldwych, W.C.2.]

Battery Lids

Dublin.

The Editor, *Plastics*.

Dear Sir,—The writer has been granted a Provisional Patent No. 8,335 (Eire) for the fitting of Transparent Lids to automobile and similar types of batteries.

We wonder if this would be of interest to any manufacturers of plastic mouldings with a view to taking up the patent either outright or on royalty basis.

We might mention that the plastic must be transparent, flameproof and able to withstand the action of battery electrolyte, viz., sulphuric acid 1,280 sp. gr.

We have in mind a suitable plastic which fulfils the requirements, and would be glad to hear from any moulding firms who may be interested.

HARRY BRAINE AND SONS.

From a Government Department

The Editor, *Plastics*.

Dear Sir,—With reference to the interesting article on page 99 of *Plastics* for March, 1939, I am enclosing a copy of the Specification for a non-distorting medium required by this department.

We have been in communication with the firms shown below, but so far Astralon, E.C. Foil and Perspex have been found the most satisfactory. However, none of these is absolutely suitable.

New plastics are constantly being introduced, and we are hoping to find a transparent plastic which will exactly meet our requirements.

It would be greatly appreciated if you could suggest any suitable plastics, together with the names and addresses of the makers.

Specification

Stability.—It must not vary in size or distort from its true shape by more than one part in five thousand with time nor under the conditions of changing temperature and humidity to be met with during its use.

Surface.—The surface must be suitable for drawing the finest lines in ink, and preferably in inks in normal use, such as Higgin's waterproof. A special ink could be contemplated, but would be somewhat of a drawback. The ink must adhere permanently to the surface and must not chip off. On the other hand, it must be capable of being erased quickly and efficiently, either with a chemical or by scraping with a knife. The surface after erasure must, again, be suitable for drawing.

The surface must also be suitable for receiving the following photographic and inked-up prints: transfers, photographic blue and black prints from positives and negatives, and inked-up prints from "helio" negatives or from positives made by positive printing-down processes.

Transparency.—The substance should be almost transparent or highly translucent. On the other hand, a partially opaque or completely opaque substance could be made use of, but it would mean that we should have to change, to some extent, our technique.

Glass and ground glass, if suitably surfaced, would both be good from the point of view of transparency, but there are disadvantages of breakability, weight and storage space and difficulties about suitable surfacing.

Thickness, Rigidity, Weight.—The substance must be capable of being stored easily, and should take as little storage space as possible.

The substance must lie flat and remain free from cockles during handling. It must also remain stable in size during handling.

The weight should be as low as possible, especially for field use, where one man carries six sheets size 17 ins. by 18½ ins.

It would be a great advantage to be able to cut the substance easily and accurately for butt-jointing and overpinning.

Size.—From 17 ins. by 18½ ins. up to 45 ins. by 38 ins. approximately.

Other Properties.—Preferably unbreakable and non-inflammable.

Photographic Properties.—If opaque, or partially opaque, the surface should be such as to reflect the maximum amount of light which will be effective on wet and dry photographic process plates. It must also keep this property through the course of years.

Price of Sheets, including Suitable Surfacing.—If opaque, prices from 5s. to 10s. for the small size 17 ins. by 18½ ins., and from £1 to 30s. for the large size 45 ins. by 38 ins. can be considered.

If translucent or transparent, prices 1½ times to twice these can be considered.

Materials at Present in Use.—(i) Opaque. Zinc or aluminium sheets suitably surfaced with white enamel. Also anodized aluminium.

(ii) Transparent. Sheet glass, suitably surfaced. Astralon, E.C. foil, Novatrace, Kartotrace, Perspex.

Working Conditions.—Temperature range, 5 degrees C. to 40 degree C. Humidity range, 40 per cent. to 100 per cent. relative humidity.

[EDITOR'S NOTE.—Since the inquirer has made no mention of polystyrol, we wonder if he has tried it. In view of the relative humidity conditions which might prevail, it might prove useful since polystyrol, we believe, is least affected by water of all plastics. In fact, water absorption is usually given as nil, and it would, therefore, be less liable to distort on this account. Distortion, due to rise or fall of temperature, would probably be of the

same order as Perspex or Astralon. Polystyrol is manufactured in this country under the names of Bexone (B.X. Plastics, Ltd.) and Distrene (Distillers Co., Ltd.), but, unfortunately, so far only in moulding powder form. The first-named company, we understand, is experimenting with the production of sheet and should be approached. The material is transparent, although not so transparent as glass, and much less so than Perspex.

Although the range of temperature in the specification is not very wide, it may be worth while considering for future work and for other uses some form of sheet plastic which would incorporate metal within it, so that the coefficient of heat transfer would approach that of metal. One can readily visualize a sheet manufactured with a fine metal gauze (a special acetate sheet is already on the market), or even the inclusion of very finely divided copper or other metal prior to sheeting.

Drinking Beakers

Brighton.

The Editor, *Plastics*.

Dear Sir,—Will you please put us in touch with the makers of Bakelite or plastic drinking beakers?

GEORGE AND BARTLE (SUSSEX), LTD.

[EDITOR'S NOTE.—The following people have stock moulds for plastic drinking beakers and are able to supply the finished goods:—British Xylonite Co., Ltd. (Hale End, London, E.4), N.B. Mouldings, Ltd. (Tremlett Grove Works, Highgate, London, N.19), and Stadium, Ltd. 75, Paul Street, London, E.C.2).]

Hydrogen and Helium

Thames House, Millbank,
Westminster, London, S.W.1.

The Editor, *Plastics*.

Dear Sir,—We feel sure that if your reader "C.A.M." takes advantage of your reply and gets into touch with this company we shall be able to offer him any service he requires in connection with supplies of hydrogen and helium.

In case he should write for further information, may we advise you that our nearest branch to Newtown Butler is at Musgrave Channel Road, Belfast? They will be very pleased to pass on any inquiries.

THE BRITISH OXYGEN CO., LTD.

Stoving Lacquers

Vauxhall.

The Editor, *Plastics*.

Dear Sir,—We have for some months past been interested in the production of a gold stoving lacquer with a Bakelite resin base for application to the interior of tinplate covers for sealing containers of preserved foods, that is, foods which are subjected to preservation at a temperature of 240 degrees F. for one, two or three hours, according to size.

We took this matter up with Bakelite Co., A. Holden and Co., Ltd., and Ingham Clark, Ltd., but it would appear that owing to the very volatile nature of the solvent used for the Bakelite resin that a suitable lacquer could not be produced which could be applied by the roller method to tinplates, and it would seem that the matter has been dropped as we have not heard anything further.

We may say we have tried some of this lacquer with a Bakelite base experimentally, and found that it was eminently satisfactory, far surpassing the present-day lacquers for its protecting action to the surface of tinplate when used for the purpose above named.

We note by the B.I.F. supplement of *Chemistry and Industry*, dated February 18, that Messrs. Bakelite, Ltd., were exhibiting various lacquers, etc., at their stand, Castle Bromwich, and we have written them asking whether they have been able to solve the problem of a satisfactory gold stoving lacquer for protecting the surface of tinplate when it is used for covers or glass containers, or the inside of tin cans.

We think this is a matter which needs investigation by the research department connected with plastics.

BRAND AND CO., LTD.

Plastic Screws

Belfast.

The Editor, *Plastics*.

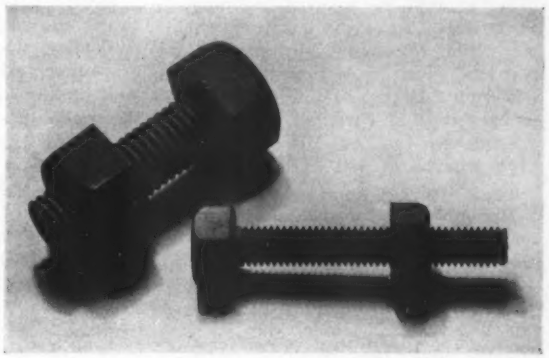
Dear Sir,—We inquire if there is a resin substance on the market for screws; if so, we would welcome the manufacturer's name and address.

These screws would have to be 4 ins. in length and ¼ in. to $\frac{5}{16}$ in. diameter, also must stand a strain of, say, 56 lb. to 112 lb. sudden jerk.

We will welcome your fullest particulars, as we will have to get a mixture of brass and bronze to meet the strain, as steel will not answer the purpose, unless it is Firth's Staybright. These screws will be in contact with damp and they must be rustless.

AUTOMATIC BUFFER CO.

[EDITOR'S NOTE.—In our May, 1938, issue we described some of the screws, nuts and bolts made by Ellison Insulations, Ltd. These are cut from resin impregnated



laminated fabric, are extremely tough, readily withstand sudden shock and, of course, are rustless. They should prove what the inquirer wants.]

Curtain Rails

Watford.

The Editor, *Plastics*.

Dear Sir,—We should be glad if you could give us the name(s) of the manufacturers of, or selling agents for, curtain rails manufactured in plastics.

We should appreciate this information at your convenience. WATFORD IDEAL HOMES, LTD.

Vauxhall.

[EDITOR'S NOTE.—The only manufacturer of the plastic curtain rail of the runner type we know is the Dap Manufacturing Co. (51, The Mall, Ealing, London, W.5). We described this extruded type in our October, 1938, issue. Inquiries should also be made of Ebonestos Industries, Ltd. (Excelsior Works, Rollins Street, London, S.E.15), who have also begun a very interesting process for similar work.]

TRADE AND PERSONAL NOTES

The Standing Committee appointed by the Board of Trade is to consider whether imported goods of the following descriptions should be required to bear an indication of origin: buckles, slides and clasps made wholly or mainly of wood or plastic materials for use with wearing apparel. All communications on the subject of these inquiries should be addressed to Mr. C. E. Kells, at the Board of Trade Offices, Great George Street, London, S.W.1.

Imperial Chemical Industries, Ltd., have sent us the third and latest issue of *Neoprene News*, which contains a good deal of information likely to further the application of synthetic rubber in a number of important industries.

British Industrial Plastics, Ltd., have forwarded us the current issue of the *Beetle Magazine*, which, as usual, is full of interest to the industry. An outstanding article of national importance at the moment is by Dr. Herbert Levinstein, M.Sc., F.I.C., on "The Impact of Plastics On Industry," which deals specifically with the need for national planning. There is also an article describing the production of amino-resin moulding powders which is a reprint of the article on "Beetle," published in the January issue of *Plastics*.

Ashdowns, Ltd., St. Helens, Lancs, have sent us a well-illustrated brochure which describes, briefly, a few of the moulding materials in common use to-day, with their chief characteristics and comparative technical data. Reference is also made to the staff and equipment now available at the company's extensive factory, and it is stressed that the technical staff, research department and designers are always willing to co-operate fully with prospective customers.

Siemens Electric Lamps and Supplies, Ltd., illustrate and describe a wide range of electrical goods in their new booklet just issued to the trade. It is devoted primarily to house service cut-outs and power fuse boxes in Bakelite and cast iron. The full range represented in the booklet includes sealing chambers, neutral boxes, carriers, bases and cartridges.

E. K. Cole, Ltd., of Southend-on-Sea, who have provided shelters for their 3,000 employees, pass on the following details of the lighting system for the interest and information of others contemplating similar A.R.P. work.

In view of the possibility of a failure in the mains electricity supply during an air raid, it is inadvisable to depend solely upon it for shelter illumination, and the alternative of a "stand-by" generating plant, accumulators, dry batteries, oil lamps or candles must be considered.

The last two are ruled out on the grounds of fire risk and consumption of oxygen when burning. Accumulators of the heavy-duty car type would probably be suitable for a small shelter, but, in a large shelter, the number required and the difficulties of charging, if the mains should fail for a long period, render them of doubtful suitability. There remain the alternatives of a generating plant and dry batteries, and both of these have been adopted for the Ekco shelters.

The generating plant is a straightforward four-cylinder water-cooled petrol engine direct coupled to a dynamo capable of supplying 3 kilowatts at 110 volts D.C., and this is the main source of emergency lighting. The system has been safeguarded in various ways against breakdown, but if complete failure should occur there are a number of individual dry battery torches hung at close intervals throughout the galleries.

These galleries, it should be explained, are laid out in a series of rectangles, the object being to give protection against splinters and blast and to localize, as far as possible, the results of a direct hit. There are seven rectangles, as the trenches are constructed at present, and 28 galleries, with at least two means of exit from any point.

Every rectangle is lit by 22 lamps. These are fed by two circuits, each wired separately right back to the power-room, and, of course, separately fused.

Each of these circuits is arranged to form a ring main round the square, and the lamps are connected to the two ring mains alternately.

In this way a clean break in each ring main will not result in a failure, and two or more breaks, or a short in one circuit with not more than one clean break in the other, will still leave alternate lamps in operation.

A direct hit on the power plant would, naturally, necessitate resorting to the dry battery torches, but the plant and main distributing cables have been covered with an additional 9 ins. of concrete and rubble to give them extra protection.

Each square of the shelter is wired for four additional lamps, one at each corner, independently of the ring mains, and these are connected to the 230-volt A.C. mains supply. This has been done chiefly so that practices may be carried out without the necessity of running the emergency generator. As an additional safeguard, the switchgear is so arranged that groups of two 110-volt ring main circuits can be put in series and run off the 230-volt mains supply if desired. This device is obviously applicable only where the generator voltage bears suitable relation to the mains voltage.

Perhaps the best arrangement would be to have two ring mains round each square of shelter, each operating direct from the 230-volt mains, with a change-over to 230-volt generator, operated automatically on failure of the main supply. Alternatively, if importance is attached to the possibility of live wire ends appearing after a bomb explosion, a transformer might be used for the mains and the whole system run at 110 volts, and, by earthing the centre of the secondary winding, the maximum potential above earth at any point could be reduced to 55 volts.

Synthetic rubber is to be manufactured on a large scale in the Soviet Union, according to a statement by the Commissar for the Chemical Industry, reported to Helsinki from Moscow and transmitted by Reuter. Seventeen factories are being built in various parts of the country for this purpose. The intention is to make Russia entirely independent of foreign rubber imports.

Mr. E. J. Luster, director of Catalin, Ltd., Waltham Abbey, Essex, is returning to the United States to rejoin the parent company. In wishing Mr. Luster au revoir and good luck, we should like to express our thanks for the ready co-operation he has always extended to us. Mr. S. R. Devlin is taking over Mr. Luster's duties and we wish him every success.

Mr. N. J. L. Megson, M.Sc., A.I.C., head of the Plastics Section, Chemical Research Laboratory, gave a lecture to the Institution of Professional Civil Servants on "The Modern Uses of Plastics" at the Royal Society of Arts, London, March 31.

British Cellophane, Ltd., present their Empire Number of *20th Century*, which makes unusually lavish use of photographs and drawings and should prove of interest to many readers.

Mr. Oliver Bernard, the well-known architect and designer, died suddenly last month. His death will be greatly regretted by his numerous friends in the plastics industry. Mr. Bernard had a fine war service and was mentioned in dispatches and decorated with the M.C. At the time of his death he was engaged on work of national importance, viz., the camouflaging of Admiralty dockyards and buildings from the air.

NEW MATERIALS—NEW PLANT—NEW METHODS

New Vinyl Resin Injection Moulding Powder

Bexone is the name of a new vinyl resin injection moulding material manufactured and marketed by B.X. Plastics, Ltd., a subsidiary of the British Xylonite Co., Ltd., and is stated to be one of the toughest plastic materials known to-day and particularly useful when thin sections are required. The following properties are given by B.X. Plastics, Ltd.:—

Inflammability ...	Burns with difficulty
Specific gravity ...	1.14-1.16
Resistance to abrasion	Very high
Hardness	Celluloid
Compression moulding temperature	100-120 deg. C.
Compression moulding pressure	2,000-3,000 lb./sq. in.
Tensile strength	8,000 lb./sq. in.
Compressive strength	27,000 lb./sq. in.
Impact strength (notched bar) ...	5-6 ft. lb./sq. in.
Young's Modulus	32,000-35,000 Kgs./cm.2
Softening point ...	70-75 deg. C.
Water absorption	2 per cent.
Coefficient of linear expansion	0.000065 per deg. C.
Breakdown voltage (60 cycles)	400-800 volts per mil.
Ultra-violet test...	Unaffected
Injection moulding temperature	About 190 deg. C. (but varies with type and size of mould)

Industry At Welwyn

An interesting new book issued by Welwyn Garden City, Ltd., deals with the many excellent facilities offered to industry in the area controlled by the Company. The book may be said to be arranged in three sections, the first section serving as an introduction to the principal types of industry carried on in the town, proving that Welwyn is not limited as are many of the older industrial areas to particular trades, but has attained a sound balance of industry and employment as a result of a variety of manufactures. The existence of so many prosperous undertakings, some of which are of international importance, implies that the town possesses services and facilities which are considered essential for the successful conduct of modern industry, and establishes Welwyn's claim for consideration as a possible location for new works. The second section contains brief details of these services and facilities, referring in particular to the several forms of industrial development—from the large site to the small workshop—to the position of Welwyn in relation to London and its advantages as a centre of distribution to the Home Market, all this information being presented in a form which enables the main facts to be rapidly assimilated. The third section attempts to show something of the charm and beauty of the town. An important fact regarding the town, which is well worth taking into consideration, is that Welwyn is entirely free from smoke pollution and is therefore healthier and more pleasant a place to work in than most other industrial centres.

Acetobutyrate Plastics

Some interesting data regarding these plastics is given in the latest supplement dealing with The Plastics Industry In America, published by the Thomas Publishing Company, 471, Eighth Avenue, New York City, U.S.A.

The new thermoplastic moulding material made from cellulose acetate butyrate can briefly be described as a material having all the advantages of both cellulose acetate and cellulose nitrate and practically none of their disadvantages.

Moisture Absorption.—Depending somewhat on flow, it absorbs on immersion about the same amount of water as nitrocellulose plastic. This is about half as much as acetate.

Flow.—Compared with cellulose acetate plastic, for injection moulding, acetobutyrate plastic requires less pressure. Up to a certain point flow increases uniformly with the temperature, but beyond that critical temperature it flows considerably faster. Thus, in a small degree, it approaches the characteristic of metals having a definite melting point.

Weld.—This factor is markedly improved in acetobutyrate plastics and is evidenced by improved strength and lack of flow lines in articles of relatively thick section. The improvement is due to the lower viscosity of the heated plastic after it passes the critical point.

Heat Resistance.—Due to the fact that there is this critical temperature above which this flows very freely, it is possible to make a plastic which below the moulding temperature has much greater resistance to heat.

New Mixing Plant

The triplex dry blender made by The Paterson Engineering Co., Ltd., Windsor House, Kingsway, London, W.C.2, is of interest to all plastic material manufacturers using mixing plant.

The basic principle of operation of the triplex dry blender illustrated is the division of the material into thirds by geometric progression, in addition to which the material undergoes the conventional mixing process during its travel, due to rotation of the cylinders.

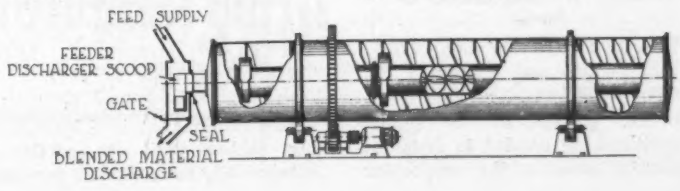
The material fed to the blender at the left enters a single helicoid screw flight fastened to the outer shell, travelling one-third the length of the blender, where it enters a double helicoid screw flight, thus being divided into two distinct streams. When the third compartment is reached, the material enters a triple helicoid screw flight and division into three distinct streams is accomplished.

Each of the three compartments of the outer cylinder is equipped with individual scoops, which pick up one-third of the material and deposit it in the inner cylinder. Again, it is divided into sections travelling left toward the starting point the length of one compartment, or one-third the length of the blender, where one stream is permitted to return to the outer cylinder and a double stream carried through the second compartment. Another stream is dropped at the end of the second compartment and the third near the feed end of the machine.

The result is mechanical division in thirds, and because of geometric progression the mixing proceeds rapidly, four cycles causing 81 divisions or practically complete mixing. One cycle averages approximately 15 revolutions.

Discharge may be accomplished, by reversing the direction of rotation, through the feed opening, or may be arranged at the opposite end. Power consumption is very low, and thorough blending is accomplished without generation of internal heat, crushing of particles or dead spots.

Obvious outlets for such plants are in shellac and resin mixing for gramophone manufacture; mixing of synthetic resin and the addition of fillers such as asbestos, wood-flours, etc., in resin powder manufacture. It is vitally important that a perfectly homogeneous blend should be obtained, and for this reason a highly efficient mixing plant is essential.



PATENTS RELATING TO PLASTICS

These abridgments of recently published specifications are specially compiled for this journal by permission of the Controller of His Majesty's Stationery Office. Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet, as issued, on payment of 5s. per group volume, or in bound volumes, price 2s. each, and the full specifications can be obtained from the same address price 1s. each.

499,559. Cellular Rubber

UNITED STATES RUBBER PRODUCTS, Inc. April 14, 1938.

Cellular rubber or artificial rubber in which substantially all the cells are closed is made by mixing a vulcanizable rubber mix with a material capable of generating an inflating gas under the influence of heat, heating the mix to develop the inflating gas while allowing the mass to expand against an exteriorly imposed gaseous counter pressure sufficient to restrain the inflating gas from rupturing the cells, reducing the gaseous counter-pressure to permit further expansion of the mass, and then completing the vulcanization of the mass while it is confined under conditions preventing any substantial diffusion from the mass of the inflating gas, for example, in a closed mould. The inflating gas may be nitrogen which may be generated by the interaction of sodium nitrate and ammonium acetate, carbon dioxide.

499,215. Moulding Sliding-clasp Fasteners by Injection

ROHM and HAAS AKT.-GES. July 19, 1937.

Sliding-clasp fasteners are formed by the direct casting of the fastener elements on to the tapes from material containing methacrylic acid derivatives of a low to medium degree of polymerization, i.e., the degree of polymerization is such that a 10 per cent. solution in ethyl acetate has a flow time less than 100 times the flow time of ethyl acetate.

499,667. Rubber Inspection Covers

METALASTIK, Ltd., and GOLDSCHMIDT, M. July 30, 1937.

An inspection cover for machinery comprises a skeleton of metal embedded in a layer of rubber, the skeleton extending into, and being parallel to a flange forming a packing face. The skeleton may be formed of strips round which the rubber is moulded, or it may be of perforated sheet or of wire mesh coated by dipping.

498,256. Bonding Rubber to Metal

DUNLOP RUBBER CO., LTD., TWISS, D. F., and JONES, F. A. October 23, 1937.

Rubber, guttapercha, or similar compositions are bonded to metal by treating the surface of the composition and/or of the metal with a fluid medium containing a compound of a heavy metal and one or more dissolved halogens concurrently or in successive steps, and subsequently bringing the surfaces into contact preferably under pressure and applying heat. The composition may contain vulcanizing agents so that vulcanization may take place simultaneously with the bonding. The fluid medium may be aqueous or otherwise and may contain rubber or rubber compositions similar to that of the rubber composition to be bonded.

498,495. Fibrous Tubes

BRITISH THOMSON-HOUSTON CO., LTD. March 31, 1937.

An arc-extinguishing tube for an electric switch is made by a method which comprises impregnating a carrier material in loose condition, and consisting of a hydrate-cellulose or a cellulose containing an oxidizing medium (for example nitrated cellulose, or cellulose previously treated with inorganic nitrate solution such as ammonium nitrate) with urea resin material or the individual components thereof in stages, and subsequently bringing said materials into tube formation accompanied by hardening of the resin.

498,840. Moulding Synthetic Resin

GROVES, W. W. (Deutsche Celluloid-Fabrik). July 15, 1937.

Artificial leather is made by successively hot-pressing on to a flexible sheet material such as paper or fabrics at least two differently coloured layers of a vinyl polymer, and producing a deep grain by a calendering which locally exposes a lower layer. Polyvinyl chloride, chlorinated polyvinyl chloride, polystyrene, polyacrylic and polymethacrylic acid derivatives, e.g., polymethyl acrylate, polyvinyl ethers, polyvinyl acetals, polyvinyl alcohol, polyvinyl organic esters, and polyvinyl acetate acetals are specified as well as mixed polymers of the monomers of these compounds with each other or with other monomers, e.g., from vinyl chloride and methyl acrylate or maleic acid derivatives.

498,858. Chlorinated Rubber

DOD, L. T., SNOW, C. I., and IMPERIAL CHEMICAL INDUSTRIES, Ltd. July 16, 1937.

Electrical apparatus is insulated with a material obtained by chlorinating rubber until it contains not substantially more than 20 per cent. of chlorine, and subsequently vulcanizing. Highly chlorinated rubber may be mixed with the lightly chlorinated rubber before vulcanization, suitable proportions being 20-67 per cent. lightly chlorinated to 80-33 per cent. of highly chlorinated rubber. According to an example, 20 parts of rubber containing 4 per cent. of chlorine and 80 parts of rubber containing 65 per cent. of chlorine are rolled into sheets 1 mm. thick and vulcanized by immersion in sulphur monochloride.

499,136. Resinous Compositions.

SKINNER, G. D., and BENJAMIN ELECTRIC, Ltd. June 14, 1937.

Luminescent material, e.g., zinc-cadmium sulphide containing copper, is mixed with a clear artificial resin such as polystyrene, e.g., two parts by volume of the resinous material may be mixed with one part by volume of the luminescent powder, or the luminescent powder is mixed with a solvent or lacquer solution of the resin and is sprayed on to one side of a sheet of the resin, the solvent causing the luminescent powder to be absorbed into the resin.

499,333. Moulding Synthetic Resins by Injection

FAWCETT, E. W., GIBSON, R. O., PERRIN, M. W., PATON, J. G., WILLIAMS, E. G., and IMPERIAL CHEMICAL INDUSTRIES, Ltd. July 22, 1937.

Articles are prepared from solid polymers of ethylene, with or without the addition of fillers, opacifying or colouring materials, by injection moulding.

498,293. Porous Masses

RUDOLPH, H. June 1, 1937.

Porous masses are obtained from fibrous granular or powdery synthetic resins by superficial softening of the individual particles, shaping under pressure to yield a porous body, and terminating the softening influences. The softening may be effected by solvents or by heat.

498,273. Motor-horn Casings

SEKLEHNER, V., and WESSELY, P. Dec. 24, 1937.

The casing and/or the apertured cover plate of an electromagnetic horn for motor vehicles is made of a rubber composition which in its moulded or final state is hard and keeps its shape and possesses a high sound-damping effect.

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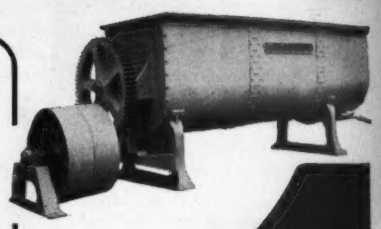

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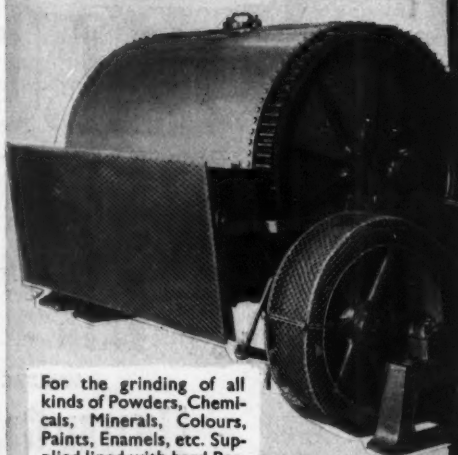

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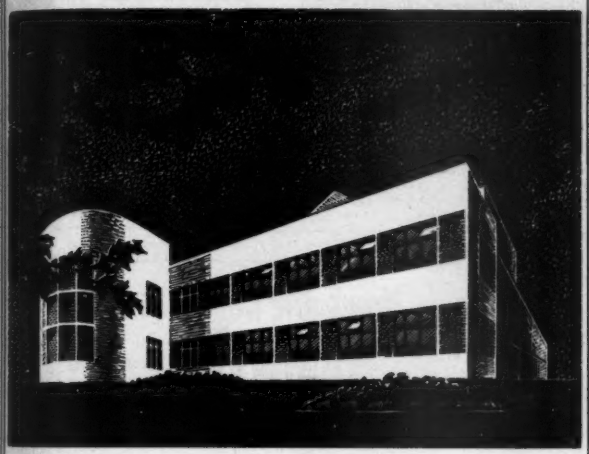

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